ISSN 0377-9335

entomon

A Quarterly Journal of Entomological Research

Vol. 5 JUNE 1980 No. 2

PUBLISHED BY

THE ASSOCIATION FOR ADVANCEMENT OF ENTOMOLOGY

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF KERALA, KARIAVATTOM,

TRIVANDRUM, INDIA 695581

ENTOMON

Entomon is a quarterly journal of the Association for Advancement of Entomology issued in March, June, September and December, devoted to publication of research work on various aspects of insects and other land arthropods excluding gross anatomy, histology and morphology.

Address MS and all editorial correspondence to the Managing Editor, *Entomon*, Department of Zoology, University of Kerala, Kariavattom, Trivandrum, India 695581.

SUBSCRIPTION RATES

Annual subscription for institutions: Rs 80/– (in India); $ 30/– (abroad)
„ „ individuals: Rs 50/– „ ; $ 20/– „

ADVERTISEMENT RATES

Full page Rs 200/–; Half page Rs 125/–; quarter page Rs 75/–

Address all business correspondence to the Secretary-Treasurer of the Association.

1. **All remittances to the journal or the Association should be sent to the Secretary-Treasurer of the Association.**
2. **Cheques should be A/c payee in favour of the Association for Advancement of Entomology.**
3. **Requests for replacement copies of ENTOMON in lieu of numbers lost in transit, should reach the Secretary – Treasurer not later than three months (nine months for requests from abroad) after the date of issue of the number.**

entomon

Volume 5 June 1980 Number 2

CONTENTS

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 85 *to* 89

RELATIVE EFFICACY OF SOME SYSTEMIC INSECTICIDES USED FOR THE CONTROL OF SORGHUM SHOOT FLY AND THEIR RESIDUES IN SOIL AND PLANTS

M. G. JOTWANI, K. P. SRIVASTAVA, N. P. AGNIHOTRI* & H. K. JAIN*
Division of Entomology, Indian Agricultural Research Institute, New Delhi, India 110 012

(*Received 26 January 1980*)

Trials were conducted to determine the relative efficacy of carbofuran seed and granular treatments as well as fensulfothion and disulfoton granules for the control of sorghum shoot fly. Under moderately heavy infestation of shoot fly all the treatments were found to be effective. Disulfoton granules proved to be somewhat less effective than carbofuran seed and granular treatments and fensulfothion granules. Studies on residues in soil showed that disulfoton was reduced to nondetectable levels within 45 days while carbofuran and fensulfothion persisted for longer period but residues of these insecticides also could not be detected on the 60th day. Sufficiently high quantities of these insecticides persisted upto 25th day in the plant tissues but they were reduced to nondetectable levels in the fodder within 70 days. However, residues of carbofuran (seed treatment), disulfoton and fensulfothion persisted in the green earheads to the extent of 0.3, 0.2 and 0.4 ppm respectively.

(*Key words: Atherigona soccata*, **sorghum shoot fly, carbofuran, disulfoton, fensulfothion, residues**)

INTRODUCTION

The shoot fly, *Atherigona soccata* (RONDANI), attacks the sorghum crop at seedling stage, causing withering of the central shoot, a typical symptom known as 'dead heart'. Under Delhi condition, there are two peaks of shoot fly activity one during *kharif i. e.*, July to September and another during summer *i. e.*, March and April when even 100 per cent dead hearts have been recorded (JOTWANI *et al.*, 1970). Effective control of shoot fly with some systemic insecticides has been reported by a number of workers on the crop sown in main *kharif* season. While very little information is available on the persistence of residues of different insecticides used for the control of shoot fly in *kharif* season, there is no data on this aspect for summer crop. Investigations were, therefore, undertaken to study the efficacy and residues of three systemic insecticides *viz.*, carbofuran, disulfoton and fensulfothion, found effective for the control of shoot fly in preliminary summer trials.

MATERIAL AND METHODS

The trial was laid out in the farm area of the Indian Agricultural Research Institute, New Delhi in a randomised block design with five treatments each replicated four times. A sub-plot consisted of 4 rows, each row measuring 3 metres. The row to row and plant to plant distances were maintained at 75 cm and 15 cm respectively. The crop was sown on March 22nd and was harvested after 70 days of sowing on June 1st. The soil was sandy loam with pH value of 8.2. The mean maximum temperatures during the experiment varied from 31.8 to 40.1°C and minimum from 11.5 to 24.6°C. The rain fall in April and May was 57.8 and 38.8mm respectively. The mean relative humidity varied from 35.2 to 61.8 per cent. The crop was irrigated regularly at 15–20 days intervals. The treatments used were as follows: T_1-carbofuran 50 SP @ 5 parts/100 parts of seed: T_2-carbofuran 3G @ 3.0 g/m row

* Division of Agricultural Chemicals.

in furrows at the time of sowing; T_3-disulfoton 3G @ 3.0 g/m row in furrows at the time of sowing; T_4-fensulfothion 5G @ 3.0 g/m row in furrows at the time of sowing; T_5 control (no treatment).

Carbofuran seed treatment with 50 SP was given 5.0 parts/100 parts of seeds using the same procedure as described by JOTWANI & SUKHANI (1968). The granular insecticides were applied in bands in seed furrows before sowing of seeds. In the case of disulfoton and fensulfothion, before putting the seed, granules were covered with a thin layer of soil by running a stick on the sides of the furrows. The rates of application of granules were 3.0 g/m row. For applying insecticides at the prescribed rates, special glass applicators were prepared for the three insecticides.

Estimation of residues in soil and plants

The residues of carbofuran in soil and plants were determined by the acid hydrolysis method of COOK *et al.* (1969). The extracts were cleaned by shaking with activated charcoal and passing it through an adsorbent column containing mixture of Celite 545 and activated charcoal (1:2) over a layer of anhydrous sodium sulphate. The residues in the eluates were analysed by electron capture gas liquid chromatography after hydrolysing the carbamate and derivatising with 1-fluro-2, 4-dinitrobenzene as described by HOLDEN *et al.* (1969) and HOLDEN (1973). A Tracor MT 200 model gas-chromatograph equipped with electron capture detector and a 1.8 m glass column containing 3% OV-17 on Chromsorb W 80/100 mesh was used. The residues of disulfoton and fensulfothion in soil and plants were extracted and analysed colorimetrically by the method described by AGNIHOTRI *et al.* (1975) and JAIN *et al.* (1974).

RESULTS AND DISCUSSION

Efficacy of various treatments was determined by taking observations on dead hearts caused by shoot fly on 20th day after germination. Percentage shoot fly damages was calculated from the total number of healthy and damaged plants per plot. The data are recorded in Table 1.

It is seen from the data that the shoot fly infestation was moderately severe which resulted in 50.62% dead hearts in control. All treatments showed highly significant reduction in shoot fly damage as compared to control. The percentage dead hearts in the treatments ranged from 0.00 to 9.95 per cent as compared to 50.62 in control. Between the insecticidal treatments, disulfoton granular treatment was found to be inferior to other three treatments.

Residues in soil

The initial deposits in carbofuran, disulfoton and fensulfothion granular treatments were 4.45, 6.45 and 7.35 ppm respectively. There was rapid decrease in the amount initially deposited in all the insecticides (Table 2 and Fig. 1). The loss of carbofuran, disulfoton and fensulfothion was 30.3, 50.4 and 27.9 per cent during the first 15 day period and 87.1, 95.3 and 83.0 per cent within 30 days of the treatment.

Residues in plants

The data on residues of carbofuran and fensulfothion in plants on 7th, 25th and 70th day (harvest time) after germination are presented in Table 2. On the 7th day, residues in carbofuran seed treatment seedlings were 32.60 ppm whereas in granular applications the residues of carbofuran, disulfoton and fensulfothion varied from 3.45 – 4.55 ppm only. Thus initial pick up was much higher in the treatment where carbofuran was coated on seed than in treatments where granular application was given. Higher amount of insecticide in the case of carbofuran seed treatment may be attributed to the fact that all the insecticide was in direct contact with roots resulting in rapid and greater uptake of the available insecticide. Similarly in granular treatments in soil, initial residue content is comparatively less possibly because relatively less insecticide was available in the vicinity of the root zone.

During 7th to 25th day after germination there was very heavy reduction in residues

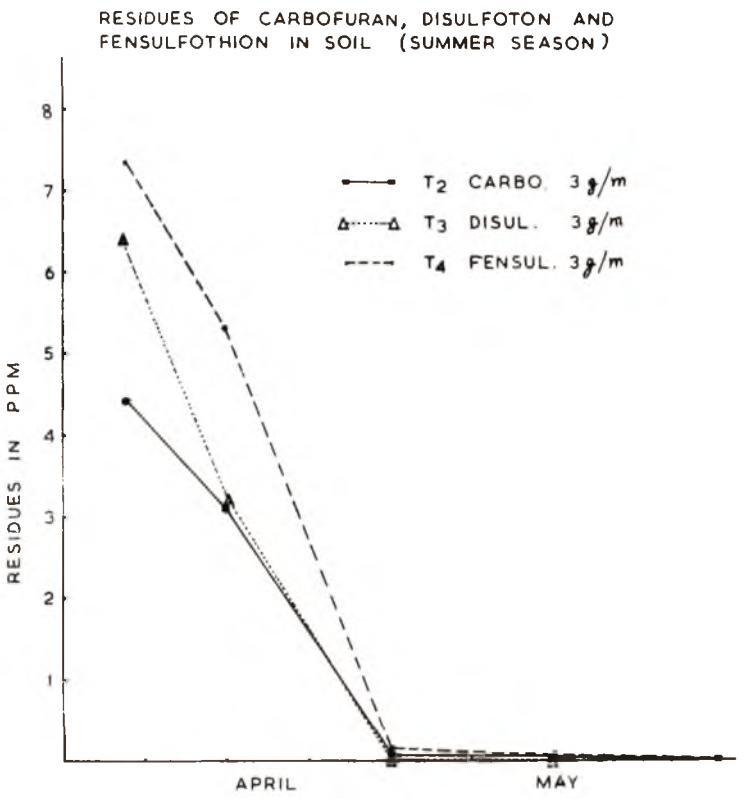


TABLE 1. Relative efficacy of insecticides for the control of sorghum shoot fly.

Treatment No.	Treatment	Average percentage dead hearts (20 days after germination)
T_1	Carbofuran 50 SP @ 5 parts/100 parts of seeds	0.75 (3.51)
T_2	Carbofuran 3G @ 3.0 g/m row in the furrow at the time of sowing	0.46 (1.92)
T_3	Disulfoton 5G @ 3.0 g/m row in the furrow at the time of sowing	3.99 (9.95)
T_4	Fensulfothion 5G @ 3.0 g/m row in the furrow at the time of sowing	0.00 (0.00)
T_5	Control (no treatment)	59.63 (50.62)
	S Em ±	2.50
	C D at 5%	7.69
	C D at 1%	10.69

Figures in parentheses are transformed values = Arc sin $\sqrt{\text{percentage}}$

in carbofuran seed treatment and it was even lower than in the granular treatment. This was possibly due to rapid uptake of most of the available insecticide at the initial stage, dilution of the amount already taken in the rapidly growing plant, higher degradation rate and practically no fresh uptake as the roots must have moved down, far away from the seed coat, the source of residual insecticide. However, in spite of this phenomenon, there was sufficient amount present in the plants for protection against shoot fly damage.

Comparison of the residue data of the three granular treatments shows that carbofuran, though used at lower rate, was relatively taken-up more rapidly and readily and its degradation was much slower than that of disulfoton and fensulfothion.

Another conclusion which is drawn from the data is that even under severe conditions of high temperatures and low relative humidities the insecticide persisted in sufficient quantities in the soil and the plants to give effective control of the shoot fly up to 20 days which is critical period for shoot fly damage.

In summer season, seed setting is very poor in sorghum due to high prevailing temperatures at the time of flowering. The plants were therefore harvested on the 70th day when earheads were still green. No detectable residues were found in fodder in any of the treatments. The earheads were found to contain 0.4 ppm fensulfothion, 0.2 ppm disulfoton and 0.3 ppm carbofuran (in seed treatment). Presence of insecticide residues in developing grains indicates the long persistence of these insecticides in growing plant tissues as compared to soil where residues could not be detected on 60th day after application.

TABLE 2. Residues of carbofuran, disulfoton and fensulfothion in soil and plants.

Treatment	Insecticide	Residues in soil (pp m)					Residues in plant (pp m)			
		Days after germination					Days after germination			
		6	15	30	45	60	7	25	70	
									Fodder	Green earhead
T_1	Carbofuran 50 S P @ 5 parts/ 100 parts of seed	..	..	..	..	..	32.60	3.95	ND	0. 3
T_2	Carbofuran 3G @ 3.0 g/m row in furrows at the time of sowing	4.45	3.10	0.40	0.15	ND	4.55	8.25	ND	ND
T_3	Disulfoton 5G @ 3.0 g/m row in furrows at the time of sowing	6.45	3.20	0.15	ND	ND	3.45	2.45	ND	0.2
T_4	Fensulfothion 5G @ 3.0 g/m row in furrows at the time of sowing	7.35	5.30	0.90	0.45	ND	3.55	4.85	ND	0.4

ND = Nondetectable

SRIVASTAVA (1975) has also reported non-detectable residues of carbofuran used as seed treatment as well as granular formulation, after 60 days of application. He did not find any residues of carbofuran in the harvested crop. Thus it is presumed that the smaller amounts of these residues found in green earheads in the case of carbofuran seed treatment as well as disulfoton and fensulfothion granular treatments would have completely degraded if the crop had been harvested at the usual time after grain formation. However, the important point which has emerged from these results is that the earheads from the summer crop should not be used as fodder for cattle.

Acknowledgements:—The authors are grateful to Heads of the Divisions of Entomology and Agricultural Chemicals for providing necessary facilities to carry out this work. Thanks are also due to Shri G.D. JADHAV for his assistance in the residues determination.

REFERENCES

AGNIHOTRI, N.P., H.K. JAIN, S.Y. PANDEY, R.S. DEWAN, A.N. SAXENA & K. M. PESHWANI (1975) Influence of soil moisture on the dissipation of phorate and disulfoton in soil and mustard crop (*Brassica campestris* L.). *Indian J. Ent.*, **37**:68-71.

COOK, R.F., R. P. STANOVICK & C. C. Cassil (1969) Determination of carbofuran and its carbonate metabolite residues in corn using a nitrogen specific gas chromatography detector. *J. agric. Fd Chem.*, **17**: 277–282.

HOLDEN, E. R. (1973) Gas chromatographic determination of residues of methyl carbamate insecticides in crops as their 2,3–dinitrophenyl ether derivatives. *J. Ass. off. anal. Chem.*, **56**: 713-717.

HOLDEN, E.R., W.M. JONES & M. BEROZA (1969) Determination of residues of methyl and dimethyl carbamate insecticides by gas chromatography of their 2, 4–Dinitroanilline derivative. *J. agric Fd Chem.*, **17**: 56–59.

JAIN, H.K., S.Y. PANDEY, N. P. AGNIHOTRI & R.S. Dewan (1974) Rapid estimation of organophosphorus pesticides. *Indian J. Ent.*, **36**: 145–146.

JOTWANI, M.G., K.K. MARWAHA, K.M. SRIVASTAVA & W. R. YOUNG (1970) Seasonal incidence of shoot fly (*Atherigona varia soccata* ROND.) in *jowar* hybrids at Delhi. *Indian J. Ent.*, **32**: 7–15.

JOTWANI, M.G. & T. R. SUKHANI (1968) Seed treatment of sorghum for the control of shoot fly (*Atherigona varia soccata* ROND.) *Pesticides*, **2**: 40–41.

SRIVASTAVA, K.P. (1975) Chemical control of sorghum pests and studies on persistence of insecticides used on sorghum crop. Ph.D. Thesis, Post-Graduate School, Indian Agricultural Research Institute, New Delhi.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 91 *to* 97

EVALUATION OF SYSTEMIC INSECTICIDES AGAINST GREEN PEACH APHID, *MYZUS PERSICAE* SULZER ON POTATO CROP

S. S. MISRA[1], D. K. NAGIA[2], GULAB RAM[3], B. S. BIST[4] & LAKSHMAN LAL[5]
Central Potato Research Institute, Simla (HP), India 171 001

(*Received 22 August 1979*)

Field evaluation of granular systemic insecticides indicated that out of them six viz., mephosfolan, disulfoton, monocrotophos, phorate, aldicarb and carbofuran each @ 1.0 and 1.5 kg ai / ha were effective in reducing and keeping down the population of green peach aphid, *M. persicae* SULZER when applied in one dose either at planting or first earthing up or half at planting and half at first earthing up. In another field evaluation, four systemic foliar insecticides viz., oxydemeton-methyl, dimethoate, thiometon and phosphamidon each at 0.025 and 0.05 per cent concentrations proved effective in keeping down the population of *M. persicae* upto 12 days but 0.05 per cent oxydemeton-methyl and dimethoate were most effective. With a view to reducing and keeping down *M. persicae* population throughout the crop season, the potato fields already treated with granular systemic insecticides may be supplemented, especially during later stages, by applying 1-2 need based sprayings with systemic foliar insecticides at 0.025-0.03% concentration @ 1250 l of spray fluid/ha. If granular systemic insecticides were not given at planting and the crop is to be protected only by applying foliar systemic insecticides, 3-5 sprayings with any of the effective foliar systemic insecticides (preferably with oxydemeton-methyl or dimethoate) at 0.025-0.03% concentration 1250 l of spray fluid/ha may be given at 10-15 day intervals for keeping the seed potato crop under perfect aphidicidal umbrella during entire crop season.

(*Key words:* **phorate, aldicarb, disulfoton, carbofuran, dimethoate, mephosfolan, monocrotophos, fensulfothion, oxydemeton-methyl, thiometon, phosphamidon, green peach aphid, *Myzus persicae* systemic insecticides**)

INTRODUCTION

Out of the various species of aphids recorded on potato crop from India, green peach aphid, *Myzus persicae* SULZER is most important (VERMA, 1977). Aphids transmit virus diseases from diseased to healthy potato plants which eventually lead to "running out" of potato varieties. In India, the losses in potato yield due to leaf roll virus and potato virus Y are estimated to be 20 to 50 per cent and 40 to 85 per cent respectively (NAGAICH & AGRAWAL, 1969). Eradication of aphid vectors with the help of modern insecticides should possibly control the spread of virus diseases which would also facilitate the growing of healthy seed potatoes. The earlier used insecticides for controlling the aphids need a serious reconsideration and re-evaluation against the present day systemic insecticides. Therefore, the present investigations were undertaken with a view to comparing the relative efficacy of some newer systemic granules with those promising granular insecticides reported earlier by various workers (NIRULA & KUMAR, 1969; RIZVI *et al.*, 1976; VERMA *et al.*, 1976;

[1] Division of Entomology, Central Potato Research Institute, Simla 171 001.
[2], [3] Section of Entomology, Central Potato Research Station, Patna 801 506.
[4] Section of Statistics, Central Potato Research Institute, Simla 171 001.
[5] Section of Entomology, Central Potato Research Station, Jullundur 144 003.

ANONYMOUS, 1977). Besides, an experiment to evaluate the efficacy of foliar systemic insecticides was also conducted in order to find out the potent foliar systemic insecticides which could substitute or supplement the systemic granules.

MATERIALS AND METHODS

Field experiments in split-plot design, with triplicate treatments, were conducted using disease free variety *Kufri Sindhuri* during 1975–76 and 1976–77 at Central Potato Research Station, Patna (Bihar). Each plot (3.6 × 2.6 m) had 6 rows containing 13 plants each. The plants were spaced 20 cm within the rows, which were 60 cm apart.

During 1975–76, seven granular systemic insecticides viz. phorate, aldicarb, disulfoton, carbofuran, dimethoate, mephosfolan and monocrotophos were included as main treatment. Combinations of two dosages in the three different manners of each insecticides were included as sub-treatments. These consisted of 1.0 and 1.5 kg ai/ha dosages of granular insecticides applied (i) full dose at planting (on 27.11.75), (ii) full dose at first earthing time (on 6.1.76) and (iii) in equal split dosages (1/2 dose at planting and remaining 1/2 at first earthing time). During 1976–77 the experiment was repeated, for which the planting was done on 1.11.76 and the plants were earthed up for the first time on 25.11.76. Monocrotophos granules were replaced with fensulfothion granules during 1976–77 due to the nonavailability of the former. The fields were suitably irrigated 5 times during both the years.

The aphidicidal effect of the granular insecticides was evaluated by recording *M. persicae* population at 5±1 day intervals on 10 plants (30 compound leaves) per plot. Such observations were started as soon as aphids started appearing on the crop.

Another field experiment was conducted with potato variety *Kufri Chandramukhi* during spring 1978 in 3.0×4.0 m plots at Central Potato Research Station, Jullundur (Punjab) for evaluation of four foliar systemic insecticides against *M. persicae*. Each plot contained 5 rows of 16 plants each. The plants were spaced as described earlier. The experimental plots were irrigated 7 times at 7–13 day intervals. Additional agronomic practices recommended for the region were followed. There were 9 treatments which were replicated three times in randomised block design.

Four foliar systemic insecticides *viz.*, oxydemeton methyl E C, dimethoate E C, thiometon E C, and phosphamidon E C, were sprayed on potato foliage in two concentrations each viz., 0.025 and 0.05 per cent active ingradient of spray fluid @ 1250 l/ha. Control plots were sprayed with water.

The aphidicidal effect of the foliar systemic insecticides was evaluated by recording the population of *M. persicae* on 10 plants (30 compound leaves) per plot, after 3,6,9 and 12 day of spray treatment.

The analysis of varience of data was carried out after square root transformation $\sqrt{(x+1}$ and $\sqrt{(x+0.5)}$, respectively, in case of tables 1,2 and 3, as suggested by SNEDECOR (1956).

RESULTS AND DISCUSSION

Granular application : The data reported in Table 1 (for the year 1975–76) indicate that mephosfolan and disulfoton were found to be the most effective insecticides but were at par with monocrotophos, aldicarb and phorate for the control of *M. persicae*. Both the dosages (1.0 and 1.5 kg ai/ha) proved almost equally effective in checking the aphid population whether applied in full dosages at planting / first earthing time or in equal split dosages.

Data on interaction between the insecticides, dosages and time of application revealed that the effective granular insecticides, when each applied @ 0.50 kg ai/ha at planting + 0.05 kg ai/ha at first earthing time (in equal split dosages) or 1.50 kg ai/ha at planting (full dosages), or 1.50 kg ai/ha at first earthing time (full dosages), or 0–75 kg ai/ha at planting + 0.75 kg ai/ha at first earthing time (in equal split dosages) were the best suited combinations in keeping down the population of *M. persicae* for a relatively longer period.

In 1976–77 also mephosfolan and disulfoton were the most effective insecticides (Table 2) but statistically at par with aldicarb, phorate and carbofuran. In general, the results were

TABLE 1. Efficacy of granular systemic insecticides against aphid (*Myzus persicae* SULZ.); main crop 1975–76.

Insecticide, its formulation dose and time of application	Average* number of aphids per 10 plants (30 compound leaves) on different dates after planting time application on 27.11.75 and first earthing time application on 6.1.76						
	19.1.76	24.1.76	29.1.76	2.2.76	7.2.76	12.2.76	17.2.76
(*A*) *Main plot:* Insecticides							
Phorate (Thimet 10 G)	1.16 (0.35)	1.43 (1.04)	1.81 (2.28)	2.60 (5.76)	3.00 (8.00)	3.28 (9.76)	2.29 (4.24)
Aldicarb (Themik 10 G)	1.11 (0.23)	1.33 (0.77)	2.16 (3.67)	3.20 (9.24)	3.12 (8.73)	2.78 (6.73)	2.55 (5.50)
Disulfoton (Disyston 5 G)	1.15 (0.32)	1.20 (0.44)	1.56 (1.43)	2.36 (4.57)	2.21 (3.88)	2.23 (3.97)	1.45 (1.10)
Carbofuran (Furadan 3 G)	1.17 (0.37)	1.21 (0.46)	2.02 (3.08)	3.19 (9.18)	2.65 (6.02)	4.01 (15.08)	2.80 (6.84)
Dimethoate (Rogor 5 G)	1.14 (0.30)	1.78 (2.17)	2.82 (6.95)	4.20 (16.64)	2.96 (7.76)	3.19 (9.18)	1.89 (2.57)
Mephosfolan (Cytrolane 5 G)	1.08 (0.17)	1.35 (0.82)	1.68 (1.82)	1.94 (2.76)	2.23 (3.97)	1.78 (2.17)	1.82 (2.31)
Monocrotophos (Azodrin 10 G)	1.18 (0.39)	1.32 (0.74)	3.02 (8.12)	3.22 (9.32)	3.11 (8.67)	2.71 (6.34)	1.88 (2.53)
SEM ±	0.04	0.16	0.24	0.47	0.65	0.47	0.25
CD (0.05)	N S	N S	0.67	1.45	N S	1.45	0.78
(*B*) *Sub plot:* Dose & time of application							
Control (no insecticide)	1.15 (0.32)	1.48 (1.19)	2.84 (7.07)	4.17 (16.39)	4.48 (19.07)	3.62 (12.10)	2.20 (3.84)
1.0 kg ai / ha at planting	1.18 (0.39)	1.63 (1.66)	2.29 (4.24)	3.36 (10.29)	3.32 (10.02)	2.95 (7.70)	2.13 (3.54)
1.0 kg ai / ha at first earthing time	1.18 (0.39)	1.27 (0.61)	2.19 (3.80)	2.81 (6.90)	2.84 (7.07)	2.36 (4.57)	1.85 (2.42)
0.5 kg ai / ha at planting + 0.5 kg ai / ha at first earthing	1.10 (0.21)	1.52 (1.31)	1.95 (2.80)	3.11 (8.67)	2.45 (5.00)	3.06 (8.36)	1.99 (2.96)
1.5 kg ai / ha at planting	1.06 (0.12)	1.53 (1.34)	1.70 (1.89)	2.34 (4.48)	2.19 (3.80)	2.64 (5.97)	2.31 (4.34)
1.5 kg ai / ha at 1st earthing	1.17 (0.37)	1.11 (0.23)	2.17 (3.71)	2.61 (5.81)	2.01 (3.04)	2.56 (5.55)	2.41 (4.81)
0.75 kg ai / ha at planting + 0.75 kg ai / ha at 1st earthing	1.20 (0.44)	1.07 (0.14)	1.92 (2.69)	2.30 (4.29)	1.98 (1.92)	2.78 (6.73)	1.97 (2.88)
SEM ±	0.06	0.19	0.19	0.34	0.26	0.32	0.19
CD (0.05)	N S	N S	0.53	0.94	0.72	0.89	N S

Figures in parentheses indicate retransformation in original units; ai = active ingredients

N S = Not significant, * = Average of three replications.

TABLE 2. Efficacy of granular systemic insecticides against aphid (*Myzus persicae* SULZ.); main crop 1976–77.

Insecticide its formulation dose and time of application	Average* number of aphids per 10 plants (30 compound leaves) on different dates after planting time application 1.11.76 and first earthing time application 25.1.76						
	31.12.76	6.1.77	10.1.77	15.1.77	20.1.77	25.1.77	31.1.77
(*A*) *Main polt:* Insecticides							
Phorate (Thimet 10 G)	1.16 (0.34)	1.84 (2.39)	3.03 (8.18)	3.37 (10.36)	3.56 (11.67)	5.63 (30.70)	6.11 (36.33)
Aldicarb (Temik 10 G)	1.24 (0.54)	1.16 (0.35)	2.13 (3.54)	2.69 (6.24)	2.52 (5.35)	5.64 (30.81)	5.90 (33.81)
Disulfoton (Disyston 5 G)	1.18 (0.39)	1.18 (0.39)	1.49 (1.22)	1.79 (2.20)	3.53 (11.46)	4.45 (18.80)	5.26 (26.67)
Carbofuran (Furadan 3 G)	1.14 (0.30)	1.22 (0.49)	2.20 (3.84)	3.11 (8.67)	3.76 (13.14)	6.83 (45.65)	10.11 (101.21)
Dimethoate (Rogor 5 G)	1.13 (0.28)	1.34 (0.80)	3.09 (8.55)	2.61 (5.81)	4.91 (23.11)	6.49 (41.12)	9.66 (92.32)
Mephosfolan (Cytrolane 5 G)	1.12 (0.25)	1.44 (1.07)	1.49 (1.22)	1.62 (1.62)	2.73 (6.45)	3.68 (12.54)	4.69 (21.00)
Fensulfothion (Dasanit 5 G)	1.23 (0.51)	2.02 (3.08)	3.45 (10.90)	3.56 (11.67)	4.57 (19.88)	7.66 (57.68)	9.72 (93.48)
SEM ±	0.09	0.27	0.47	0.34	0.61	1.03	1.07
CD (0.05)	N S	N S	1.45	1.05	1.69	N S	3.30
(*B*) *Sub-plot:* Dose & time of application							
Control (no insecticide)	1.45 (1.10)	1.69 (1.86)	4.02 (15.16)	5.03 (24.30)	7.09 (49.27)	8.45 (70.40)	10.93(118.46)
1.0 kg ai / ha at planting	1.15 (0.32)	1.51 (1.28)	2.39 (4.71)	1.55 (1.40)	2.53 (5.40)	4.73 (21.37)	6.13 (36.58)
1.0 kg ai / ha at 1st earthing time	1.23 (0.51)	1.49 (1.22)	1.91 (2.65)	2.84 (7.07)	4.01 (15.08)	6.85 (45.92)	7.58 (56.46)
0.5 kg ai / ha at planting + 0.5 kg ai / ha at 1st earthing time	1.04 (0.08)	1.59 (1.53)	1.99 (2.96)	2.11 (3.45)	3.17 (9.05)	5.38 (27.94)	6.73 (44.29)
1.5 kg ai/ ha at planting	1.09 (0.19)	1.43 (1.04)	2.13 (3.54)	2.19 (3.80)	2.97 (7.82)	5.54 (29.69)	7.03 (48.42)
1.5 kg ai / ha at 1st earthing time	1.14 (0.30)	1.14 (0.30)	2.77 (6.67)	3.20 (9.24)	2.96 (7.76)	5.60 (30.36)	7.07 (48.98)
0.75 kg ai / ha at planting + 0.75 kg ai / ha at 1st earthing time	1.09 (0.19)	1.33 (0.77)	1.67 (1.79)	1.83 (2.35)	2.87 (7.24)	3.81 (13.52)	5.96 (34.52)
SEM ±	.0.07	0.20	0.41	0.45	0.64	0.81	1.06
CD (0.05)	0.19	N S	1.14	1.25	1.76	2.24	2.94

Figures in parentheses indicate retransformation in original units; ai = active ingredient

N S = Not significant; * = Average of three replications.

in agreement with those obtained for the preceding year.

As regards the interaction between insecticides, dosages and time of application of granules, it was observed that combination of effective granular insecticides @ 1.5 kg ai/ha dosages whether applied in full at planting/first earthing time or in equal split dosages proved superior over other combinations and control. Besides, 1.0 kg ai/ha dose of effective insecticides when applied in two equal split dosages ie., ½ at planting + ½ at first earthing time was also an effective combination in checking the aphid population.

Spray application : It is evident from the data given in Table 3 that 3 days after spray treatment, all the four foliar systemic insecticides viz., oxydementon-methyl, dimethoate, thiometon and phosphamidon at 0.025 and 0.05% concentration each were significantly superior over control in reducing and keeping down the aphid population. Besides, 0.05% concentration of oxydemeton-methyl was the best treatment followed by dimethoate at 0.05% concentration which was at par with phosphamidon applied at 0·05% concentration.

After 6 days on spraying, the effect of all the insecticides at both the concentrations was found to be significantly superior over control. Oxydemeton-methyl (0.05%) gave maximum protection to the crop against *M. persicae* but was at par with dimethoate (0.05%), phosphamidon (1.05), oxydemeton-methyl thiometon (0–05%), (7.025%), dimethoate (0.025%) and phosphamidon (0.25%) in descending order of their efficacy. After 9 days, all the four insecticides were found to be superior over control but these were at par among themselves at both the concentrations. Aphid count data recorded 12 days after the spray treatment, revealed that the insecticides at 0.025 as well as 0.05% concentrations were statistically superior than the control in keeping down the *M. persicae* population. Further, all the insecticides except thiometon (0.25%) and phosphamidon (0.025%) were at par among themselves at both the concentrations.

On the basis of "overall mean" data, it is clear that all the four foliar systemic insecticides at both the concentrations were superior over control in reducing and keeping down aphid population on sprayed potato plants for a period of 12 days. However, oxydemeton-methyl at 0–05% concentration proved to be the best treatment which was at par with dimethoate at 0.05% concentration.

The data on efficacy of granular systemic soil insecticides recorded from two field experiments conducted during 1975-76 and 1976–77 (Tables 1 and 2 respectively) clearly show that mephosfolan and disulfoton, although statistically at par with phorate and aldicarb, were effective for a relatively longer time as compared to others. The granular insecticides were observed to lose their efficacy with the increase in time gap, especially during later half crop period (Tables 1 and 2).

The studies earlier conducted at this institute showed that *M. persicae* starts appearing on potato crop in the north-western plains of India from early December, and in the eastern plains (Bihar and West Bengal) in early January, reaching the critical level (20 aphids / 100 compound leaves) by the end of December in the former area end of January in the later area (VERMA & MISRA, 1975). The maximum population of this aphid is normally observed in February and March, after which it starts declining. Thus it has become a matter of necessity to give one or two supplementary sprayings with any one of the foliar systemic insecticides

TABLE 3. Efficacy of some foliar insecticides against aphid (*Myzus persicae* SULZ.) Spring crop 1978.

Insecticide and formulation	Concentration	Average* number of aphids per 10 plants (30 compound leaves) after spray treatment (Day)				
		3	6	9	12	Mean
Oxydemeton-methyl (Metasystox 25 E C)	0.025	2.98 (9.00)	2.44 (5.66)	2.10 (4.00)	1.34 (1.33)	2.21
-do-	0.05	2.06 (4.33)	1.48 (2.33)	1.26 (1.33)	0.99 (0.66)	1.44
Dimethoate (Rogor 30 EC)	0.025	2.87 (8.33)	2.78 (8.00)	2.03 (4.00)	1.08 (1.00)	2.19
-do-	0.05	2.20 (5.00)	1.73 (2.66)	1.08 (1.00)	1.16 (1.00)	1.54
Thiometon (Ekatin 25 EC)	0.025	3.59 (13.00)	3.10 (9.33)	1.92 (3.33)	2.38 (5.33)	2.74
-do-	0.05	2.99 (9.00)	2.67 (7.00)	1.33 (1.00)	2.01 (3.66)	2.25
Phosphamidon (Dimecron 100 EC)	0.025	2.90 (8.66)	2.84 (7.66)	1.49 (3.33)	2.22 (5.00)	2.36
-do-	0.05	2.75 (7.66)	2.12 (4.33)	1.46 (2.00)	1.89 (3.00)	2.04
Control (Water spray)		7.96 (63.66)	7.94 (63.99)	6.63 (45.32)	6.74 (45.66)	7.31
S E M ±		0.19	0.47	0.50	0.36	0.14
C D (0.05)		0.55	1.39	1.48	1.06	0.39

Figures in parentheses indicate retransformation in original units.

* Average of three replications.

to protect the potato crops, grown for seed purposes in plains, from aphid infestation.

Similarly from data on the efficacy of systemic foliar insecticides presented in Table 3, it is clear that all the four systemic foliar insecticides viz. oxydemeton-methyl, dimethoate, thiometon and phosphamidon even at 0.25% concentration applied @ 1250 l of spray fluid/ha could protect the seed crop from aphid infestation for 12 days following the spray treatment.

In conclusion, the potato crops grown for seed purposes in plains can be effectively protected from green peach aphid, *M. persicae* infestation either by applying any of the effective granular insecticides in the soil at planting @ 1.0–1.5 kg ai/ha during the first half crop period (this will also take care of leaf-hoppers appearing in early stages on the crops) after which by applying 1–2 need based supplemtary sprayings with any of the foliar systemic insecticides (preferably with oxydemeton-methyl or

dimethoate) at 0.025–0.03% concentration of sprayable fluid @ 1250 l/ha or only by giving 4–5 foliar sprays with any one of the foliar systemic insecticides (Table 3) at 0.025-0.03% concentration of ready to use spray fluid @ 1250 l/ha. For this, first spraying should be given soon after the germination of the crop and subsequent 3–4 sprayings (depending upon aphid population) may be given at 10–15 day intervals for keeping the seed crop under perfect aphidicidal umbrella during entire crop growing period.

Acknowledgements: Authors are grateful to Dr. B.B. NAGAICH, Director and Dr. A.P. SAXENA, Entomologist, Central Potato Research Institute Simla for providing necessary facilities and encouragements.

REFERENCES

ANONYMOUS (1977) Pests and their control. *Potato in India*. CPRI Bull. No. 1: 36. Published for and on behalf of the Director, CPRI, Simla.

Nagaich, B.B. & H. O. AGARWAL (1969) Research on potato viruses in India. *Indian J. agric. Sci.*, **30:** 286–289.

NIRULA, K.K. & RAVINDER KUMAR (1969) Soil application of systemic insecticides for control of aphid vectors and leaf-roll and 'Y' viruses in potato. *Indian J. agric. Sci.*, **39:** 699–702.

RIZVI, S.M.A., V.K. CHANDLA & B.S. BIST (1976) Evaluation of some systemic granular insecticdes against *Myzus persicae* SULZER on potatoes. *Potato Res.* **19:** 183–185.

SNEDECOR, G.W. (1956) *Statistical methods*. Iowa State College Press, Ames, Iowa, *5th Ed.*, pp. 316.

VERMA, K.D. & S.S. MISRA (1975) Be on the watch for green peach aphid. *Indian. Frng.*, **25:** (2): 7–8.

VERMA, K.D., R.P. CHAUDHURI, V.K. CHANDLA S.S. MISRA & M.L. TANDON (1976) Further studies with systemic insecticides against the green peach aphid on potatoes. *Indian J. Pl. Prot.*, **4:** 165–169.

VERMA, K. D. (1977) Aphids and their role in potato cultivation. *Recent Technology in potato Improvement & Production*. Ed. B. B. NAGAICH, CPRI Simla. p. 256.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 99 to 103

CONSUMPTION AND UTILIZATION OF DIFFERENT FOOD PLANTS BY *HELIOTHIS ARMIGERA* (HÜBNER) (NOCTUIDAE : LEPIDOPTERA)

N. DHANDAPANI & M. BALASUBRAMANIAN
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, India 641 003

(*Received 26 October 1979*)

Indices of consumption, growth, digestibility and efficiency of conversion of ingested and digested food materials from third to last instar caterpillars of *Heliothis armigera* with eight different food plants were calculated. Utilization of total nitrogen from the food plants by the caterpillars was also determined. Reasons for the disparity observed among the values were discussed.

(*Key words:* consumption and utilization of food, *Heliothis armigera*)

INTRODUCTION

Studies on the consumption, digestion and utilization of food plants by insects are important both from fundamental and applied point of view. They provide information on the quantitative loss brought about by the pests. Consumption indices can also be taken as indirect measurements of the relative susceptibilities of different varieties of crops to pest infestation. Studies on Indian insects along the lines mentioned above are few and they include those of SHYAMALA *et al.* (1960) and PREM-KUMAR *et al.* (1977). The present study was undertaken to find out the indices relating to the consumption and utilization of eight economically important food plants by the larvae of *Heliothis armigera*, a polyphagous and destructive pest of crops.

MATERIALS AND METHODS

The food consumed, excreta produced and the weight gained by the caterpillars from third to last instar were determined both on fresh- and dry weight basis. Dry weight of larvae was estimated using the mean percentage of dry matter of an aliquot of similar larvae. To find out the dry weight of the larvae they were killed by freezing and then dried at 80°C to a constant weight. The mean weight of the insects was calculated by summing up the initial and final weights determined every day and dividing by the number of weighings. The estimation of total nitrogen in the feeding material, caterpillars and faecal pellets was done by the micro-kjeldahl method. All the indices relating to the consumption, digestion and utilization of food plants were calculated according to WALDBAUER (1968).

RESULTS AND DISCUSSION

Food consumption

The total food consumed and different consumption indices (CIs) are presented in Table 1. The food consumed was significantly more in cotton and less in sunflower. The fresh weight consumption index was generally taken as a measure of the behavioural response of insects towards the food (WALDBAUER, 1968). The data presented showed that there was in general a direct correlation between the succulence of host plants (as indicated from the moisture per cent of food plants) and the feeding rate of insects, the more succulent cotton being consumed more than the less succulent sunflower.

SOO HOO & FRAENKEL (1966), WALDBAUER (1964) and PREM KUMAR *et al.* (1977) found

TABLE 1. Consumption indices (CIs) and growth rate of the larvae of *H. armigera* on different food plants.

Food plant	Moisture %	Total food consumption (gm)	Fresh weight of food: fresh weight of larva	Dry weight of food: fresh weight of larva	Dry weight of food: dry weight of larva	Growth rate
Bengalgram	9.8	1.8119	0.084	0.036	0.155	0.014
Redgram	15.2	2.4761	0.150	0.065	0.216	0.023
Lab-lab	12.1	3.4610	0.153	0.077	0.383	0.016
Cotton	80.2	4.8540	0.215	0.047	0.205	0.017
Tomato	93.1	1.9663	0.139	0.028	0.147	0.013
Sorghum	11.0	1.8810	0.099	0.064	0.307	0.011
Maize	10.1	3.1703	0.142	0.099	0.453	0.015
Sunflower	7.5	1.7397	0.086	0.053	0.197	0.047
C D (P=0.01)		0.1777	0.004	0.0087	0.007	

that the dry weight CIs were always higher than the corresponding fresh weight CIs because the insects contained a lower percentage of dry matter than their food. The present observations also corroborated these findings.

The CI calculated based on dry weight of food and fresh weight of larva was of nutritional interest since this index meausures the rate at which nutrients entered the digestive system (WALDBAUER, 1968). It was significantly high in maize and low in tomato.

Growth rate

The relative growth rates of the larvae calculated are presented in Table 2. The maximum growth rate was for the larvae fed on sunflower followed by redgram, and the minimum growth rate was for those fed on sorghum and cotton, lab-lab, maize and bengalgram occupied intermediate positions.

Approximate digestibility

Approximate digestibility (AD) taken as the index of digestibility are presented in Table 2. The AD was significantly high in tomato and less in sunflower on dry weight basis while it was maximum in sunflower and minimum in maize reared larvae on fresh weight basis. SOO HOO & FRAENKEL (1966) reported that plants with thick structural carbohydrates encompassing the individual cells are less digestible because of the more physical barrier to mechanical and enzymatic activity within the insect. The less digestibility might also be due to a nutrient deficiency or nutrient imbalance (WALDBAUER, 1962).

Utitization of food

Efficiency of conversion of ingested food to body substance (ECI) *or gross efficiency:*

The indices of gross efficiency, both on dry and fresh weight basis, are given in

TABLE 2. Growth rate of *H. armigera* on different food plants and their approximate digestibility.

Food plant	Growth rate	A D (%)	
		Dry weight basis	Fresh weight basis
Bengalgram	0.014	28.67	50.01
Redgram	0.023	31.91	41.84
Lab-lab	0.016	39.58	60.79
Cotton	0.017	27.57	46.84
Tomato	0.013	72.72	45.42
Sorghum	0.011	46.69	56.73
Maize	0.015	48.36	24.03
Sunflower	0.047	22.90	60.95
C D (P = 0.01)	0.0027	0.826	1.27

TABLE 3. Utilization of food plants by the larvae of *H. armigera*.

Food plant	E C I (%)		E C D (%)	
	Dry weight basis	Fresh weight basis	Dry weight basis	Fresh weight basis
Bengalgram	9.28	16.99	32.36	34.00
Redgram	12.80	15.30	33.44	35.29
Lab-lab	4.22	10.56	10.67	15.81
Cotton	8.33	7.97	30.24	17.01
Tomato	9.02	9.51	12.41	20.94
Sorghum	3.54	10.95	7.58	19.30
Maize	3.70	9.94	16.18	45.91
Sunflower	8.38	19.24	17.33	31.57
C D (P = 0.01)	1.29	1.27	1.74	1.41

TABLE 4. Utilization of total nitrogen by the larvae of *H. armigera* on different food plants in percentage.

Food plant	CAD (N)	ECI (N)	ECD (N)
Bengalgram	79.10	76.60	96.84
Redgram	92.18	37.41	46.58
Lab-lab	89.12	65.58	73.59
Cotton	82.84	72.66	87.70
Tomato	57.79	44.80	77.38
Sorghum	84.95	47.55	55.97
Maize	83.96	80.73	96.15
Sunflower	87.55	85.63	97.81
C D (P=0.01)	2.522	3.555	4.431

Table 3. On dry matter basis, it was significantly more for redgram and least for sorghum while on fresh weight basis, it was significantly more for sunflower and lowest gross efficiency was noted with cotton. The dry weight ECI possibly reflected better the balance of energy than the fresh weight ECI.

Efficiency with which digested food is converted to body matter (ECD) or net efficiency :

The ECD was maximum in redgram and minimum in sorghum on dry weight basis while on fresh weight basis, it was significantly high in maize and low in lab-lab. As reported by SOO HOO & FRAENKEL (1966) the high ECD might have been due to high nutritious food and faster growth of the larvae. The fresh weight ECD for sorghum, maize and sunflower were two to three times higher than corresponding dry weight ECD. This probably reflects a high rate of retention of the small amount of water taken in with the food and the storage of metabolic water obtained by the oxidation of carbohydrates (WALDBAUER, 1968).

Utilization of total nitrogen

Nitrogen was chosen as the constituent for an objective study because of the component's direct relationship with protein. Measurements of utilization of nitrogen by insects are complicated by the presence of urine in their faeces. In the present study, determination of urine nitrogen was not attempted. But still the uncorrected co-efficient of apparent digestibility (CAD) and ECI (N) should be proportionate to the corresponding corrected values, since ingested nitrogen less faecal and urine nitrogen should be same as the amount of nitrogen retained in the body (WALDBAUER, 1968).

The CAD (N), ECI (N) and ECD (N) are presented in Table 4. The CAD (N) was significantly maximum in redgram, but ECI (N) and ECD (N) were maximum in sunflower and minimum in redgram.

Acknowledgements:—The senior author expresses his gratefulness to the Indian Council of Agricultural Research, New Delhi, for financial assistance.

REFERENCES

PREM KUMAR M., D. DALE & M.R.G.K. NAIR (1977) Consumption, digestion and utilization of food by larvae of *Spodoptera litura* F. (Lepidoptera: Noctuidae). *Entomon*, **2**: 7–10.

SHYAMALA, M. B., K. SHARDA, M. G. BHAT & J.V. BHAT (1960) Chloromycetin in the nutrition of the silkworm *Bombyx mori* L. II. Influence on digestion and utilization of protein, fat and minerals. *J. Insect Physiol.*, **4**: 229–234.

SOO HOO, C.F. & G. FRAENKEL (1966) The consumption, digestion and utilization of food plants by a polyphagous insect, *Prodenia eridania* (CRAMMER). *J. Insect Physiol.*, **12**: 711–730.

WALDBAUER, G.P. (1962) The growth and reproduction of maxillectomized tobacco hornworms feeding on normally rejected nonsolanaceous plant. *Entomologia exp. appl.*, **5**: 147–158.

WALDBAUER, G.P. (1964) The consumption, digestion and utilization of solanaceous and nonsolanaceous plants by larvae of tobacco hornworm, *Protoparce sexta* (JOHAN) (Lepidoptera: Sphingidae.) *Entomologia exp. appl.*, **7**: 253–269.

WALDBAUER, G.P. (1968) The consumption and utilization of food by insects, 229–288, *in*: *Adv. Insect Physiol.*, V (ed. ROCKSTEIN, M.) Academic Press, New York.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 105 *to* 107

RELATIVE POTENCY OF INSECTICIDES AGAINST *LACHNOSTERNA (HOLOTRICHIA) CONSANGUINEA* BLANCH IN DIFFERENT TYPES OF SOILS

V. K. R. SHINDE, S. K. SHARMA & M. K. PURI
Department of Entomology, University of Udaipur,
Agricultural Research Station, Durgapura, Jaipur, Rajasthan, India

(*Received 26 October 1979*)

Laboratory tests were conducted to study the influence of soil type on the toxicity of insecticides against final instar larvae of whitegrub *Lachnosterna (Holotrichia) consanguinea* BLANCH. The three types of soils included in the test were loamy sand, sandy loam and sandy clay loam. Eight insecticides viz., aldrin, carbofuran, dimethoate, disulfoton, endosulfan, heptachlor, lindane, phorate and quinalphos were tested by incorporating them in soil and confiing the larvae in the treated soils. On the basis of comparison of LC_{50} values all the insecticides were found to be most effective in loamy sand soils followed by sandy loam and sandy clay loam. The extent to which soil type influenced the efficacy of soil treatment was dependent upon the specific insecticide used. The descending order of toxicity of insecticides in all the soils was quinalphos, phorate, carbofuran, disulfoton, heptachlor, endosulfan, lindane and aldrin.

(*Key words:* **relative potency of insecticides,** *Lachnosterna (Holotrichia) consanguinea*, **soil types**)

INTRODUCTION

Soil treatment with various insecticides for control of *Lachnosterna (Holorichia) consanguinea* BLANCH, have been recommended by RAI *et al.* (1969), SHARMA & SHINDE (1970), YADAVA & YADAVA (1973), SACHAN & PAL (1974) and many other workers. During course of evaluation of these recommendations on the farmer's field in the eastern Rajasthan with larger blocks of about 0.2 ha, it was observed that under approximately similar densities of grub population, the same insecticide, at the same dose, performed differently at different locations. Though all the trials were laid out in the lighter soils, the soil types ranged from loamy sand to sandy clay loam. It was therefore thought pertinent to examine under controlled conditions, the effect of soil types on the toxicity of soil applied insecticides to grubs of *L. (H.) consanguinea*. The findings are reported herein.

MATERIALS AND METHODS

The tests were conducted with three types of soils viz. loamy sand, sandy loam and sandy clay loam. The composition of three soils are given in Table 1. Eight insectidides viz., aldrin, carbofuran, dimethoate, disulfoton, endosulfan, heptachlor, lindane, phorate and quinalphos were tested against field collected third instar larvae of *L. (H.) consanguinea* BLANCH. Only technical grade or pure insecticides were used. For each insecticide five dosages were taken to get grub mortalities ranging from 20 to 90 percent. The dosages were taken on the basis of mg of actual ingredient of an insecticide per 1000 cubic centimeters of soil. The insecticidal solutions were prepared by dissolving the required quantity of technical grade or pure insecticide either in *n*-pentane or 9:1 *n*-pentane-acetone as solvent. For each dose, solution containing required quanity of insecticide in fixed volume of solvent was thoroughly incorporated in 2 litres (3.756 kg) of air dried soil. The solvent was allowed to evaporate at room temperature. To the treated lot, 600 ml of water was then added and thoroughly mixed. Following treatment, aliquots of soil were placed in 20 earthen pots of 7 cm diameter and in each pot single final instar grub was released to avoid cannibalism. Tender roots of sorghum were supplied as food, along with

TABLE 1. Composition of soils used in the tests.

Soil type	Mechanical analysis (Per cent composition)			pH	Total soluble salts EC mm hos per cm	Organic matter content (per cent organic carbon)	Phosphorus content P_2O_5 kg/ha	Potash content K_2O kg/ha
	Sand	Silt	Clay					
Loamy sand	86.05	10.85	1.67	8.3	0.20	0.07	36	310
Sandy loam	76.57	16.70	4.45	8.4	0.55	0.25	90	290
Sandy clay loam	40.75	39.02	19.22	7.8	0.65	0.07	99	900

TABLE 2. Toxicity of pesticides of final instar grubs of *Lachnosterna (Holotrichia) consanguinea* BLANCH in three soil types.

Insecticide	LC_{50} Values*			Relative potency		
	Loamy sand	Sandy loam	Sandy clay loam	Loamy sand	Sandy loam	Sandy clay loam
Aldrin	2.0124	2.5126	3.1012	1.54	1.23	1.00
Carbofuran	0.0314	0.0421	0.0852	2.71	0.02	1.00
Disulfoton	0.0481	0.0814	0.1251	2.60	1.53	1.00
Endosulfan	0.1927	0.3825	0.5214	2.70	1.36	1.00
Heptachlor	0.1128	0.2942	0.3152	2.79	1.07	1.00
Lindane	0.2563	0.4217	0.7823	3.05	1.86	1.00
Phorate	0.0241	0.0312	0.0392	1.62	1.25	1.00
Quinalphos	0.0182	0.0215	0.0348	1.91	1.61	1.00

*LC_{50} = mg of insecticide per litre of soil calculated to give 50 per cent mortality.

their 6 cm long stem portion for easy pullout of roots during replacement. The roots were changed after 24 hours and 24 ml of water was added to each pot to maintain soil moisture. A check with 20 pots (one grub/pot) was maintained for each insecticide with identical conditions.

Post-treatment mortality counts were taken 48 hours after. Following correction of mortalities for the kill obtained in checks, the data were subjected to probit analysis after method of FINNEY (1952 a, b) and the LC_{50} values for each insecticide under three soil types were calculated.

RESULTS AND DISCUSSION

On the basis of LC_{50} values (Table 2) it can be construed that in all the three types of soils, the decending order of toxicity of insecticides was quainalphos, phorate, carbofuran, disulfoton, heptachlor, endosulfan, lindane and aldrin. The insecticides were most toxic in loamy sand soils and least toxic in sandy clay loam soils. Taking the LC_{50} values of an insecticide in sandy clay loam soil as unity, the insecticides were 1.07 to 2.02 times more toxic in sandy loam and 1.54 to 3.05 times in loamy sand soils. HARRIS (1966) also reported that insecticides were more toxic to *Gryllus pennsylvanicus* BURMAISTER in lighter soils as compared to heavier ones. When an insecticide is applied to the soil, it gets adsorbed on the organic matter and soil particles. All the three soils included in the present test were poor in organic matter content and under such conditions, probably the clay fraction of the soil plays an important role in the adsorption of the insecticide. With the increase in the clay content more insecticide is absorbed in the soil and relatively less portion of the soil applied insecticide becomes available in the soil for insect kill. Thus it can be concluded that under heavier soils the dose of a soil applied insecticide should be correspondingly increased to get effective control of whitegrubs.

Acknowledgements:—The field assistance rendered by Mr. K.L. GARVA and Shri GOPAL LAL SHARMA is gratefully acknowledged.

REFERENCES

FINNEY, D.J. (1952 a) *Probit Analysis*, 2nd ed. Cambridge University Press, Cambridge p. 318.

FINNEY, D. J. (1952b) *Statistical Methods in Biological Assay*. 2nd ed. Charles Griffin and Co. Ltd., London, 668 p.

HARRIS, C.R. (1966) Influence of soil type on the activity of insecticides in soil. *J. econ. Ent.*, **59** : 221–225.

RAI, B.K., H.C. JOSHI, Y.K. RATORE, S.M. DUTTA & V.K.R. SHINDE (1969) Studies on whitegrub *Holotrichia consanguinea* BLANCH in Lalsot (District Jaipur) Rajasthan. *Indian J. Ent.*, **31**: 32–42.

SACHAN, J.N. & S.K. Pal (1974) Control of whitegrub *Hologtrichia insularis* BR. in chillies (*Capsium frutescens* LINN *Pesticides*, **8**: 43–45.

SHARMA, S.K. & V.K.R. SHINDE (1970) Control of whitegrub *Lachnosterna* (*Holotrichia*) *consanguinea* BLANCH (Coleoptera: Scarabaeidae). *PANS*, **16**: 176–179.

YADAVA, C.P.S. & S.R.S. YADAVA (1973) Field trials with certain commonly used soil insecticides against *Holotrichia consanguinea* BLANCH infesting groundnut. *Indian J. Ent.*, **35**: 329–332.

Entomon, 1980. *Vol.* 5, *No.* 1, *pp.* 109 *to* 111

EVALUATION OF SOME INSECTICIDES FOR THE CONTROL OF *RHYACIA HERCULEA* CORTI AND DRAUDT

G. D. VERMA & C. M. P. SINHA
Bihar Agricultural College, Sabour (Bhagalpur), Bihar, India

(*Received 23 December 1979*)

Two applications of endosulfan—first as spray @ 1.00 kg ai / ha on 14 days old maize crop and the second as granular application in plant whorls @0.25 kg ai/ha 20 days after the spraying gave the best control of the climbing cutworm, *Rhyacia herculea* CORTI & DRAUDT. infesting rabi maize in Bihar. This treatment gave an yield of 47.78 quintal per hectare with a net return of Rs 1931.60 as compared to untreated control.

(*Keywords:* **chemical control of *Rhyacia***)

INTRODUCTION

Of the several insects attacking Rabi maize (*Zea mays*) climbing cutworm, *Rhyacia, herculea* CORTI & DRAUDT. is becoming a limiting factor in maize cultivation. The larvae feed on the apical portion or the margins of the leaves leaving behind only the midrib in case of severe infestation. This pest was first found in 1962 on wheat and gram in Diara, Chaur and Tal areas of South Bihar by SINGH & SINHA (1965). VERMA *et al.* (1979) reported it from North Bihar causing severe damage where about 1.50 lakh hectares are put in rabi maize cultivation every year. Studies to evolve an effective control of this pest were made and the results of the experiment are presented in this paper.

MATERIALS AND METHODS

Seeds of maize variety Hi-starch were sown in a randomised block design at Agricultural Research Institute Farm, Dholi in Rabi, 1978. There were five treatments including an untreated control each with four replications. Each sub-plot had eight rows each of five metres length. Row to row and plant to plant distances were kept at 75 cm and 25 cm respectively. Endosulfan and quinalphos @ 1.00 kg ai/ha were sprayed on 14 days old plants. Their granular formulation @ 0.25 kg ai/ha were given in plant whorls in the respective treatments 20 days after the spraying. Three applications of BHC 10% dust were done on the plants @ 60 kg/ha–first with 15 kg on 14 days, second with 20 kg on 21 days and the third with 25 kg on 28 days old plants-Trichlorfon granules were applied in plants whorls @ 0.25 kg ai/ha on 20 days old plants followed by another application at an interval of 20 days. Assessment of damage of plants was done 15 days after the final application of insecticides in terms of percentage of plants infested and grain yield at 15% moisture.

RESULTS AND DISCUSSION

An examination of the analysis of data presented in Table 1 would reveal that the treatment differences were highly significant. The best result was obtained in case of two applications of endosulfan in spray and granular forms where minimum infestation of 18.95 per cent was observed followed by 19.57 per cent infestation under three applications of BHC dust and 20.55 per cent infestation in two applications of quinalphos as spray and granular formulation. However, there was no significant differences among these insecticides in respect of their performance. Granular application of

TABLE 1. Showing percentage of attacked plants by the climbing cutworm *R. herculea*.

Treatments	R1	R2	R3	R4	Mean
Endosulfan 35 EC + 4G	13.50 (21.56)	20.90 (27.20)	21.90 (27.90)	19.50 (26.21)	18.95 (25.72)
Quinalphos 25EC + 5G	18.48 (25.48)	22.64 (28.38)	23.90 (28.66)	18.10 (25.18)	20.55 (26.93)
BHC 10% dust	16.20 (23.73)	21.21 (27.42)	22.40 (28.25)	18.49 (25.48)	19.57 (26.22)
Trichlorfon 5G	22.50 (28.32)	22.00 (27.97)	24.42 (29.60)	25.41 (30.26)	23.58 (28.04)
Control	32.62 (34.62)	33.78 (35.55)	35.52 (36.57)	34.81 (36.15)	34.18 (35.77)
S E (Treatment)	Mean				0.9326
C D at 5%					2.0321

TABLE 2. Showing weight of grains and economics of different insecticidal treatments per hectare.

Treatments	Total yield in kg per treatment	Yield in quintal per hectare	Percentage increase over control	Additional return over control in qtl	Price Rs 120.00 per quintal (Rs)	Cost of insecticides & operation charges (Rs)	Net return over control Rs
Endosulfan	57.337	47.78	58.5	17.68	2121.60	190.00	1931.60
Quinalphos	53.849	44.87	48.7	14.77	1772.40	101.50	1670.90
BHC	54.941	45.78	51.9	15.68	1881.60	105.00	1776.60
Trichlorfon	47.742	39.48	31.9	9.68	1161.60	170.00	991.60
Control	36.124	30.10	..	..	..	..	..
	S E (Treatment) Mean		1.42 Q/ha.				
	C D at 5%		3.09 Q/ha.				

trichlorfon twice was least effective with 23.58 per cent infestation but was superior to control having 34.18 per cent infestation.

Table 2 reveals that the highest yield of 47.78 quintal per hectare (56.5 per cent increase over control) obtained in case of endosulfan followed by 45.78 quintal per hectare (51.9 per cent increase) with BHC and 44.87 quintals per hectare (48.7 per cent increase) with quinalphos were statistically at par among themselves but significantly superior to 39.78 quintals per hectare (31.9 per cent increase) obtained with the application of trichlorfon and 30.10 quintals per hectare in control.

The economics of different insecticidal treatments has revealed that an investment of Rs 190.00 as the cost of endosulfan in E C and granular form including the operation charges gave a net return of Rs 1931.60 while BHC 10% dust and its operation charges costing Rs 105.00 gave a net profit of Rs 1776.60. The lowest return of Rs 991.60 by investing Rs 170.00 was from application of trichlorfon granules.

Acknowledgements: The authors are grateful to Dr. K.K. JHA, Dean, Faculty of Agriculture and Prof. M.M. SINHA, Professor and Head, Department of Entomology, Rajendra Agricultural University, Bihar for extending necessary facilities and valuable suggestions.

REFERENCES

SINGH, M.P. & M.M. SINHA (1965) Some cutworm pests new to Bihar. *Indian J. Ent.*, **27**: 113–114.

VERMA, G.D., J. SINGH & I.P. SINGH (1979) Field evaluation of some insecticidal treatments for control of *Rhyacia herculea* CORTI & DRAUDT on rabi maize in Bihar. *Entomon*, **4**:(2) 129–131.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 113 *to* 128

TAXONOMIC STUDIES ON INDIAN MEMBRACIDAE (INSECTA : HOMOPTERA)

K. S. ANANTHASUBRAMANIAN
Department of Zoology, Loyola College,
Madras, India 600 034

(*Received 23 November 1979*)

One new genus, *Paranotus*, and 15 new species of Membracidae collected from South India are described. The genus, *Lanceonotus* Capener (1968), originally described from South Africa, is recorded for the first time from India.

(*Key words :* **Taxonomy, Indian Membracidae**)

Subfamily **Oxyrhachinae**

Tribe OXYRHACHINI

Genus *Oxyrhachis* Germar 1835

1. Oxyrhachis tuberculatus, sp. nov. (Figs. 1–3)

Male ; General colour yellowish brown. Head nearly 1.5 times as wide as long; vertex arcuate, punctate with short silvery hairs, cranial callosities raised, conspicuous, lateral angles of foliate lobes rectangularly rounded; eyes subglobate, black; ocelli convex, nearer to eyes than to each other and situated slightly above the centro–ocular line; frontoclypeus not extending below lower margins of foliate lobes, free end truncate, fringed with long whitish hairs. Pronotum greyish brown; metopidium twice as broad as high, slightly obliquely turned backwards, densely pilose; supra–ocular callosities black, prominent; humeral angles subprominent, tips blunt; suprahumeral horns moderately broad, longer than space between bases, seen in lateral view broad and raised upwards with apices turned backwards, seen from above flat dorsoventrally, seen in front very slender, raised slightly upwards and outwards, anterior and lateral carinae sparsely pilose; posterior process moderately gibbous at base, with a prominent vertical tubercle on the gibba, apical area moderately directed upwards, tip subacute, extending well beyond the tegminal tips, ventrally keeled with weak serrations, median carina percurrent through metopidium, lateral carinae dark brown. Tegmina thrice as long as broad, dull yellowish, veins pale brown, 1st spical cells 6.5 times longer than wide, apicallimbus broad. Legs ochraceous brown. Abdomen dark brown above and lighter below. Genitalia as in *tarandus* (Fabricius, 1898).

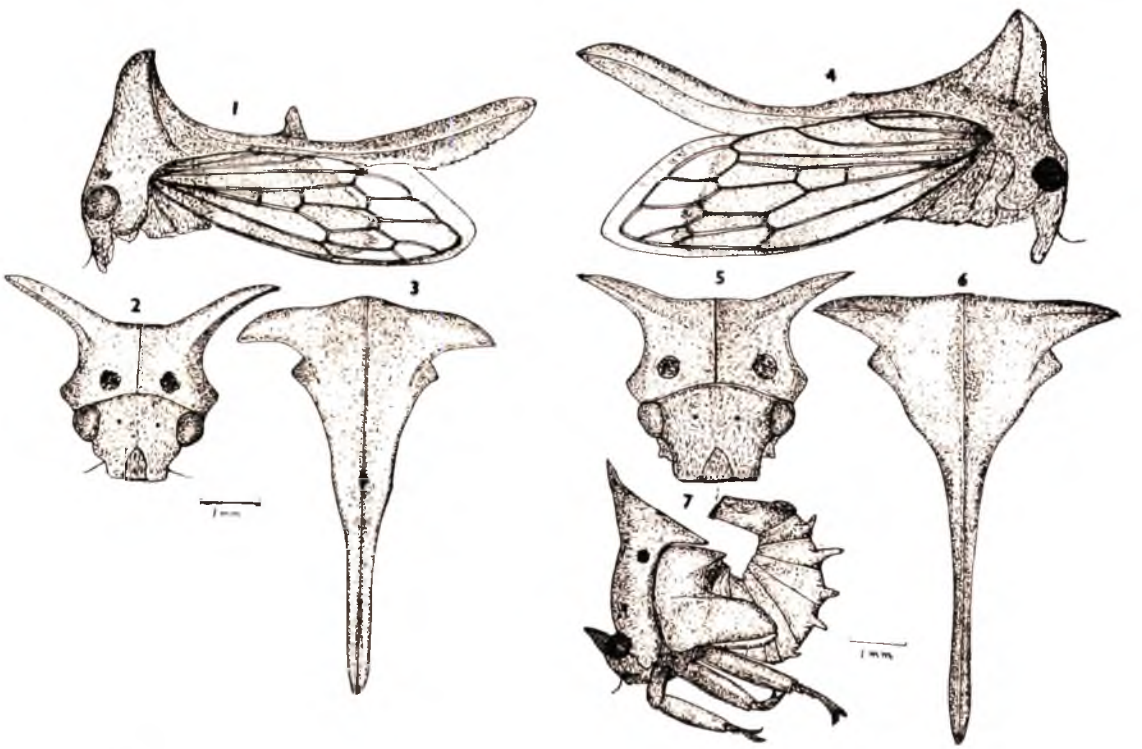
Measurements : Length from frontal margin to tip of posterior process 7.6 mm; to tips of tegmina 6.4 mm; width across tips of suprahumeral horns 4.6 mm; at humeral angles 2.7 mm; at eyes 2.2 mm.

Material examined : Holotype ♂, INDIA : TAMIL NADU, Madras, 2.ii.1979 from the host plant, *Prosopis spicigera*.

Remarks : This species is very close to *tarandus* (Fabricius) but differs in having a distinct upright tubercle on the gibba.

2. Oxyrhachis malabaricus sp. nov. (Figs. 4–7)

Female : General colour rusty brown. Head nearly two–thirds as long as wide;



Oxyrhachis tuberculatus sp. n.: 1–lateral view of male; 2–frontal view; 3–dorsal view of pronotum. *Oxyrhachis malabaricus* sp.n.: 4–lateral view of female; 5–frontal view; 6–dorsal view of pronotum; 7–fifth instar nymph.

vertex sinuate, coarsely punctate with silvery hairs, cranial callosities inconspicuous, leteral angles of foliate lobes obtusely rounded to frontoclypeus; frontoclypeus never extending below lower margins of foliate lobes, free end truncate, fringed with long white hairs; eyes pale white, slightly extending laterad; ocelli shining white, convex, slightly nearer to eyes than to each other and situated on the centro-ocular line. Pronotum dark brown; metopidium vertical, twice as wide as high, slightly obumbrant, densely pilose; supra-ocular callosities prominent, black, bare; humeral angles conspicuous, tip subacute; suprahumeral horns black, longer than space between their bases, nearly horizontal, seen in lateral view stout, directed upwards and backwards, seen from above flat, seen in front rather slender and directed outwards, lateral carina nearly straight, dorso-posterior carina curved forwards and outwards; posterior process gibbous at base, apical area moderately elevated, apex extending backwards well beyond tegmina and slightly declivous, ventral keel finely serrate, median carina strongly percurrent through metopidium. Tegmina nearly 3.5 times longer than wide, reddish brown, veins ochraceous brown, 1st apical cell about 6 times longer than wide; apical limbus moderately broad. Legs testaceous. Abdomen dark dorsally, greyish ventrally.

Measurements : Length from frontal margin to tip of posterior process 8.4 mm; to tip of tegmina 7.9 mm; width across tips of suprahumeral horns 4.75 mm at humeral angles 3.0 mm, at eyes 2.74 mm.

Fifth instar nymph : General colour chocolate brown. Head 1.5 times wider than long, directed backwards ; cranial tubercles prominent, subcylindrical, tip subacute; vertex subplanate at base; eyes pale brown; ocelli nearer to eyes than to each other and located on centro-ocular line. Pronotal anterior process nearly twice as long as posterior process, cylindrical at basal half, gradually tapering to an acuminate tip; pronotal posterior process extending over the length of mesonotum; supra-ocular callosities small, taking the form of three irregular areas; suprahumeral buds conspicuous: wing pads ferruginous, fairly large, extending upto 4th abdominal segment, costal angles more or less demarcated, fringed with tuberculated spines; abdomen excluding anal tube as long as thorax; lateral lamellae of segments 5 to 8 well developed, nearly cylindrical, inclined backwards, lacking tubercular spines; anal tube about one-fourth as long as total body length; genitallic rudiments dark brown.

Material examined : Holotype ♀, **paratype** 4 ♀ ♀, one **nepionotype,** INDIA : KERALA : Palghat, 5.ii.1979, from *Tamarindus indicus.*

Remarks: This species is nearest to *tarandus* (Fabricius) in the disposition of the suprahumeral horns and in the nymphal characters, but differs in the coloration and in the distinctly declivous apex of posterior process.

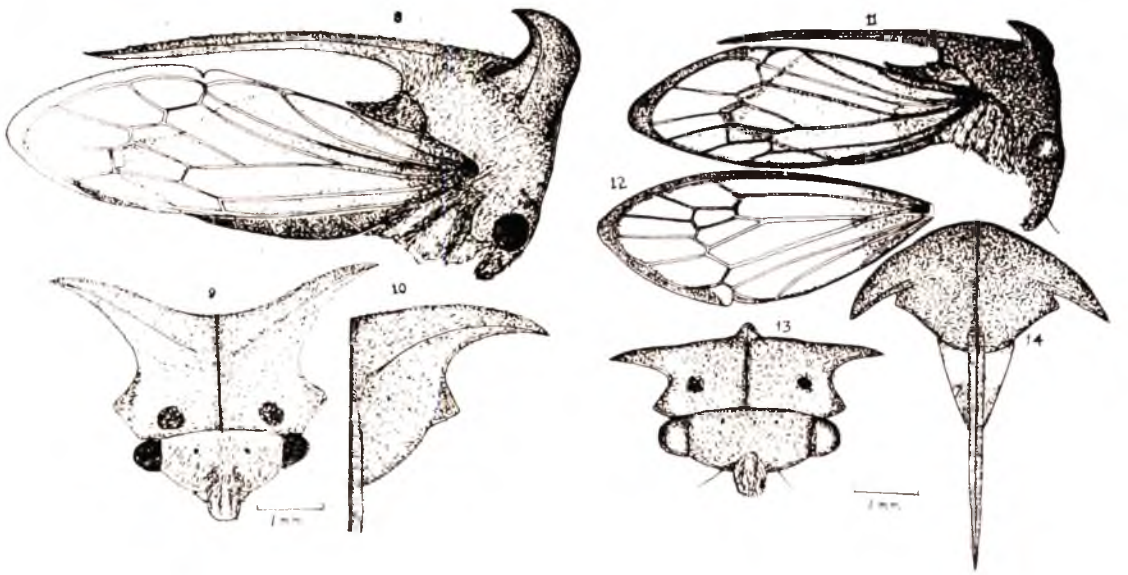
Subfamily **Centrotinae**

Tribe LEPTOCENTRINI

Genus *Leptocentrus* Stal 1866

3. Leptocentrus majesticus sp. nov.
(Figs. 8-10)

Female : General coloration shining yellow. Head nearly 2.75 times as wide as long, sprinkled with greyish dots, densely longly pilose with silvery hairs; vertex nearly planate at upper margin, lower margin downwardly convexly sloping to frontoclypeus; frontoclypeus concolorous with vertex, extending half of its length beyond lower margins of vertex, frontoclypeal lobes prominent, fringed with long hairs; eyes moderately large, globate, chocolate brown, slightly projecting laterad; ocelli silvery white, closer to eyes than to each other and located above the centro-ocular line. Pronotum luteus, coarsely punctate with long suberect hairs; lateral areas of sternum brownish, not cretaceously sericeous, metopidium slightly wider than high, convex, supraocular callosities conspicuous, brown, entire and almost bare; humeral angles subacute; suprahumeral horns yellowish brown, nearly as long as width between their bases, as seen from front moderately broad, as seen in lateral aspects a little projecting forwards upto middle, then obliquely curved backwards, as viewed from above somewhat flat, apical one-third gently curved backwards, tip sharp; posterior process rather slender, yellowish, emerging from about the middle of disc, well remote from scutellum, nearly straight upto terminal one-sixth length and gently curved near the tip, not impinging on inner tegminal margins, reaching the middle of 4th apical cell, distinctly tricarinate, lateral carinae fuscous, extending upto middle of disc, median carina strongly percurrent, continued through metopidium; scutellum as wide as long, basal hall punctate with silvery hairs, apex narrowly emarginate, slightly raised up. Tegmina a little more than 3 times as long as wide, straw-yellowish, basal sixth coriaceous, a smoky area on costal margin opposite to 1st apical cell, apical limbus moderately broad, 1st apical cell 5 times as long as wide, 2nd discoidal cell about 1.5 times longer than 1st discoidal. Legs uniformly yellowish, abdominal undersurface light brown.



Leptocentrus majesticus sp. n.: 8–lateral view of female; 9–frontal view; 10–dorsal aspect of pronotum (right half). *Lanceonotus indicus* sp. n.: 11–lateral view of male; 12–tegmina; 13–pronotal view; 14–dorsal view of pronotum.

Measurements : Length from frontal margin to tips of tegmina 8.3 mm, to tip of posterior process 7.2 mm; width across tips of suprahumeral horns 5 mm; at humeral angles 3.2 mm; at eyes 2.6 mm.

Material examined : Holotype ♀, INDIA : TAMIL NADU : Yercaud Hill, 4,800 feet, 1.iii.1979.

Remarks : This unique species is near to *varicornis* Ananthasub. & Ananthak. (1975) in the nature of the suprahumeral horns and tegminal discoidal cells but differs in the coloration of the body and in the nature of the posterior process.

Genus *Lanceonotus* Capener 1968

4. Lanceonotus indicus sp. nov. (Figs. 11–14)

Male : General coloration shining black. Vertex black, nearly 3 times as wide as long, finely punctate with sparse pilosity; upper margin arcuate, lower margins obliquely curving to frontoclypeus; eyes large, subglobate, pale white; ocelli succineous, closer to eyes than to each other and situated above centro–ocular line; frontoclypeus declivous, extending two–thirds of its length beyond lower margins of vertex, densely pilose, tip broadly rounded. Pronotum black, strongly punctate with long pilosity, metopidium vertical, 2.2 times as wide as high, supra–ocular callosities prominent, dull black, bare, humeral angles prominent, tips subacute; suprahumeral horns much shorter than space between their bases, rather slender, viewed from sides directed upwards and then backwards, slightly tricarinate, viewed from front directed laterad, tips acute, viewed from above directed obliquely backwards; posterior process emerging behind disc and vertically from posterior margin of pronotum, raised well above scutellum and directed almost horizontally caudad, slender, tricarinate, tip sharp and extending to about the middle of 5th apical cell of tegmina. Scutellum triangular, longer than wide, basally somewhat swollen and pilose, tip slightly raised,

strongly punctate with dense pilosity. Tegmina 2.5 times as long as wide, amber hyaline, basal fourth coriaceous and punctate; veins light brown, apical limbus moderately broad, tip acutely rounded, R1 oblique to subcosta, 5 apical and 2 discoidal cells, 1st apical cell twice as long as wide and based on radial sector, 2nd discoidal cell 1.3 times as long as 1st discoidal, costal margin and apical limbus shaded black. Sides of thorax cretaceously sericeous. Abdomen black.

Measurements : Length from frontal margin to tips of tegmina 6.8 mm, to tip of posterior process 5.3 mm; width across tips of suprahumeral horns 4.3 mm, at humeral angles 3·0 mm, at eyes 2.8 mm.

Female unknown.

Material examined : Holotype ♂, INDIA : TAMIL NADU, Courtalam, 4.iv.1978; collected by Mr. S. Varadarasan.

Remarks : It is of interest that *Lanceonotus* Capener, an African genus, has been recorded from India for the first time.

5. Lanceonotus cinnamomi sp. nov.
(Figs. 15–18)

Female : General coloration black; vertex greyish black, thrice as wide as long, finely punctate with long golden pilosity, upper margin arcuate, lower margins gradually roundedly curving to frontoclypeus; eyes large, deep reddish tinted with brown; ocelli large, shining white, nearer to eyes than to each other and situated above the centro–ocular line; frontoclypeus greyish, extending two-thirds of its length beyond lower margins of vertex, sparsely longly hairy, tip broadly rounded. Pronotum shining black, strongly punctate with long golden pilosity; metopidium vertical, 1.8 times as wide as high, supraocular callosities black, divided; humeral angles reddish brown; suprahumeral horns pitch black, slender, broad at base, as long as distance between their bases, sparsely pilose, viewed from sides directed upwards and strongly curved backwards, tricarinate, viewed from front directed obliquely upwards, viewed from above directed laterad, tips acute; posterior process emerging from the posterior margin of disc, raised well above scutellum, a little arched about its middle and tapering gradually to the tip, never touching the inner margins of tegmina and extending as far behind as the 4th apical cell; scutellum triangular, as long as wide, basal third densely pilose and with an oval white patch on either side, tip emarginate, black, sparsely pilose; lateral aspects of thorax white tomentose. Tegmina amber coloured, 3.5 times as long as wide, basal sixth coriaceous, apical veins yellowish, rest of the veins black, 1st apical cell wedge-shaped, 5 times longer than its width, 2nd discoidal cell longer than 1st, apical limbus very narrow, tip rounded. Abdomen black; legs dark brown except tarsi which are yellowish brown.

Measurements : Length from frontal margin to tips of tegmina 7 mm, to tip of posterior process 5.8 mm; width across tips of suprahumeral horns 4.7 mm, at humeral angles 3 mm, at eyes 2.8 mm.

Male : General coloration similar to female, but differing in the length and disposition of horns. Metopidium 2.6 times as wide as high; suprahumeral horns twice as long as distance between their bases; posterior process well arched at about its middle and its tip impinging on inner margins of tegmina.

Measurements : Length from frontal margin to tips of tegmina 6.8 mm, to tip of posterior process 5·7 mm; width across tips of suprahumeral horns 5.5 mm, at humeral angles 2.8 mm, at eyes 2.5 mm.

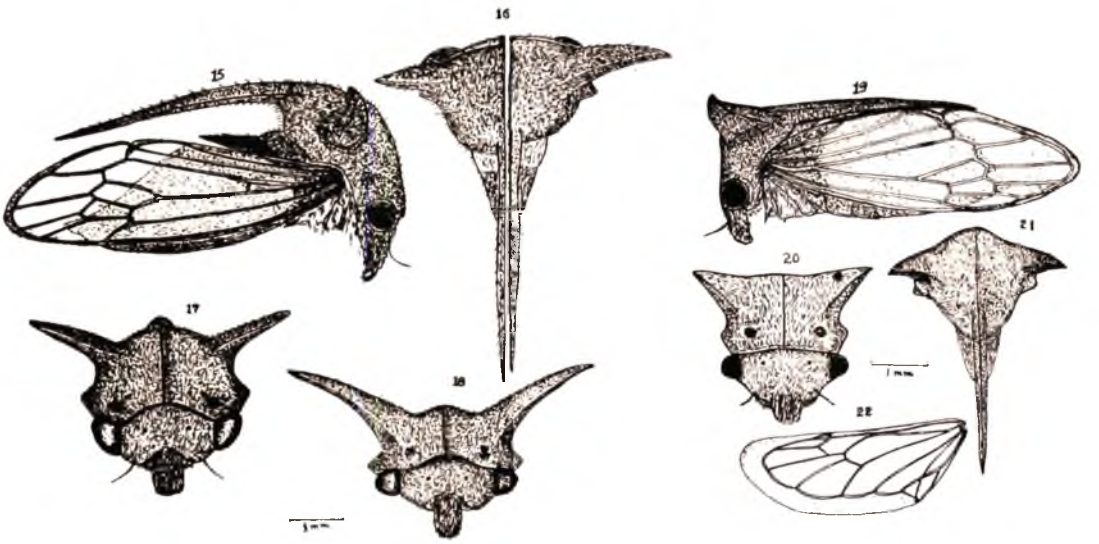
This species is very close to *indicus* from which it differs in the presence of longer suprahumeral horns, in the scutellum as long as wide, in the very narrow apical limbus, and in the nature of the 1st apical cell of the tegmina. The posterior process is also more conspicuously arched than in *indicus*.

Material examined: Holotype ♀, **allotype** ♂ and **paratype** ♂ ;INDIA: KARNATAKA: Mercara; on the host plant *Cinnamomum* sp., 21.ii.1979,

Genus *Otinotus* Buckton 1903

6. Otinotus aureus sp. nov. (Figs. 19–22)

Female: General coloration yellow. Head 2.5 times as wide as long, vertical, finely punctate with adpressed golden pilosity, weakly convex, upper margin arcuate, lower margins of vertex obliquely sloping to frontoclypeus; eyes dark brown, subglobate, projecting laterally beyond humeral angles; ocelli pale white, closer to eyes than to each other and situated above the centro-ocular line; frontoclypeus declivous, nearly as long as wide across lobes, extending nearly half its length below lower margins of vertex, tip broadly rounded, with longer pilosity. Pronotum yellowish brown, punctate with adpressed golden hairs; metopidium vertical, 1.5 times as wide as high, supraocular callosities dark brown, prominent, humeral angles short, tip subacute, posterior margin obliquely directed backwards; suprahumeral horns robust, shorter than space between their bases, densely pilose, viewed from sides obliquely projecting forwards and upwards, apex acute, slightly recurved viewed from above broad-based, directed laterad with apex curved caudad, viewed from front directed outwards and upwards; posterior process tricarinate, emerging from the posterior fourth of disc, slightly raised behind scutellum contiguous with scutellum and tegmina, tip acute, reaching about the middle of 5th apical cell of tegmina; scutellum triangular, slightly longer than wider, punctate with dense golden hairs with a V-shaped notch at tip, apices acute. Tegmina about 2.5 times as long as wide



Lanceonotus cinnamomi sp. n.: 15–lateral view of female; 16–frontal view of female; 17–frontal view of male; 18–dorsal view of pronotum—Female (Left half); Male (Right half). *Otinotus aureus* sp. n.: 19–lateral view of female; 20–frontal view; 21–dorsal view of pronotum and scutellum; 22–hindwing.

hyaline, basal 6th coriaceous and punctate, veins translucent, R1 opaque and oblique, 1st apical cell stemming from R1 and Rs, 5 times as long as wide, 2nd discoidal cell about 1.3 times longer than 1st discoidal, apical limbus narrow and acutely rounded at tip. Hindwings with 4 apical cells. Legs yellowish brown. Abdomen light brown with golden pilosity.

Measurements: Length from frontal margin to tips of tegmina 6.4 mm to tip of posterior process 4.6 mm; width across tips of suprahumeral horns 3.2 mm, at humeral angles 2.3 mm, at eyes 2.2 mm.

Male unknown.

Material examined: Holotype ♀, paratypes 3 ♀ ♀, INDIA : TAMIL NADU : Somerdale, Ootacamund, 1.vi.1978.

Remarks: This species is allied to *ammon* Buckton (1903) in the nature of the tegminal apical cells and discoidal cells, but differs in the forwardly directed horns, less sinuous and more robust posterior process and in the yellow coloration of the body.

7. Otinotus mysorensis sp. nov. (Figs. 23-25)

Female: General coloration dark reddish brown. Head light greyish brown, declivous, about 2.75 times wider than long, finely punctate with adpressed golden pilosity, upper margin of vertex almost planate, lower margins obliquely sloping to fronto-clypeus; eyes dull black, subglobate; ocelli pale brown, nearer to each other than to eyes and situated well above the centro-ocular line; frontoclypeus extending to three-fourths its length below lower margins of vertex, broader than longer, tip truncate, sparsely hairy with golden pilosity. Pronotum reddish brown, metopidium light brown, twice as broad as high, finely punctate with long golden pilosity distributed sparsely, supra-ocular callosities large, divided; humeral angles prominent with subacute tips; suprahumeral horns short, black not hairy, broad at base, much shorter than space between their bases, seen from front directed outwards with terminal region turned backwards, apex sharply acute, seen from sides directed upwards and backwards; posterior process slender, arising from posterior margin of pronotum, slightly raised above apex of scutellum, sinuate, apically acuminate, contiguous with inner margins of tegmina, tip extending upto 4th apical cell of tegmina; scutellum triangular, as long as wide, dark brown with a prominent oval white spot in each basal angle, tip emarginate; tegmina 3.3 times as long as wide, pale bronzy, basal fifth coriaceous, veins yellowish brown, apical limbus rather narrow, tip acute, first apical cell 9 times as long as wide, 1st and 2nd discoidal cells of equal length: hindwings with 4 apical cells; abdomen dark brown; legs yellowish brown.

Measurements: Length from frontal margin to tips of tegmina 7.9 mm, to tip of posterior process 6.0 mm, width across tips of suprahumeral horns 4.4 mm, at humeral angles 3.4 mm, at eyes 3.0 mm.

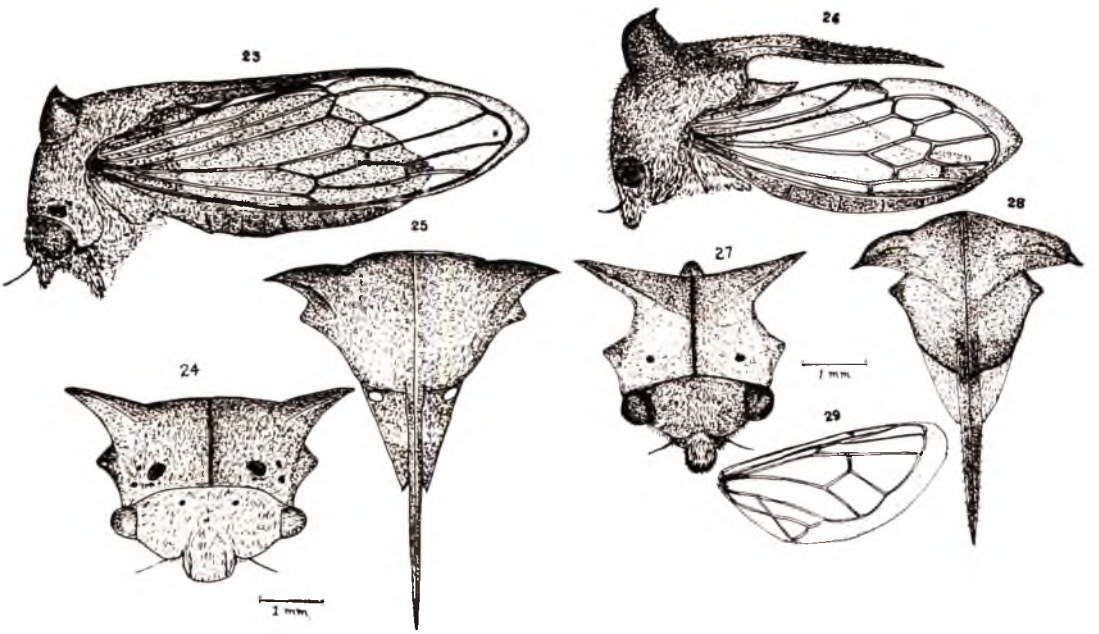
Male unknown.

Material examined: Holotype ♀, paratypes 2 ♀ ♀, INDIA: KARNATAKA, Mysore collected on 20.ii.1979.

Remarks: This species is very closely to *mimicus* Distant (1916) in the general body coloration and in the disposition of the suprahumeral horns; it differs from *mimicus* in the position of the ocelli which are closer to eyes than to each other and situated far above the centro-ocular line, and also in the nature of the first apical cell of tegmina which is 9 times as long as wide.

Paranotus gen. nov.

This genus is close to *Leptocentrus* Stall but differs in the non-declivous pronotal



Otinotus mysorensis n. sp.: 23–lateral view of female; 24–frontal view; 25–dorsal view of pronotum and sctutellum. *Paranotus tomentosus* sp.n. 26–lateral view of female; 27–frontal view; 28–dorsal view of pronotum and scutellum; 29–hindwing.

posterior process which shows an elongate medial ampliation.

Head vertical, about two and a half times wider across extremities of eyes than length of vertex; upper margin of vertex arcuate, lower margins oblique; eyes subglobate; ocelli closer to eyes than to each other and situated on the centro-ocular line; frontoclypeus slightly declivous, longer than wide extending to half of its length below lateral lobes, tip rounded, lateral lobes distinct. Pronotum moderately high; metopidium vertical, curving backward to disc, twice as wide as high, median carina percurrent, humeral angles prominent, blunt with a short oblique anterior carina, posterior angles rounded; suprahumeral horns well developed, tricarinate, directed obliquely forwards; posterior process tricarinate, emerging behind horns, a little convexly elevated at base, ventrally well above posterior margin, distant from scutellum and tegmina, elongately ampliate in middle, then gradually acuminate to tip extending well beyond anal angles of tegmina. Scutellum as long as wide. Tegmina two and a half times as long as wide, without pterostigma, with 5 apical and 2 discoidal cells, apical veins straight, nearly parallel, 1st apical cell parallel-sided, based on R1. Hind wings with 4 apical cells.

Type of the genus *Paranotus tomentosus* sp. nov.

8. Paranotus tomentosus sp. nov. (Figs. 26-29)

As in generic description, with the following additional characters:

Female: Head with vertex greyish black, finely punctate with adpressed golden hairs; vertex about 1.75 times wider than long, frontoclypeus laterally carinate with longer pilosity; antennae greyish; eyes pale white

with a hue of brown; genae tomentose; pronotum greyish yellow, finely punctate with adpressed golden hairs, an irregular golden yellow area behind horns to basal one-fourth of posterior process with denser golden pilostiy; metopidium yellow, sprinkled with pilosity, supraocular callosities black, rather obscure; disc black; suprahumeral horns black, broad at base, with golden yellow hairs, a little longer than distance between their bases, strongly tricarinate, carinae black, viewed from sides directed obliquely forwards, apex acuminate and strongly recurved, viewed from front more or less planate directed outwards and forwards, viewed from above directed outwards with the acuminate apex slightly turned backwards; posterior process shining yellow at basal one-fourth, rest black, sprinkled with dense golden pilosity, tip reaching about three- fourths the length of 5th apical cell of tegmina; scutellum finely punctate with suberect golden hairs, tip broadly concavely emarginate, apices acute; lateral aspects of thorax greyish black. Tegmina amber-hyaline with a dark brown area near claval margin between 1st and 2nd anal veins, apical limbus broad, tinted with dark brown, costal margin in the region of 1st apical cell thickened, apex subacute, 1st apical cell about 7 times as long as wide, 2nd discoidal cell slightly longer than 1st discoidal. Abdomen black. Legs uniformly yellow.

Measurements: Length from frontal margin to tips of tegmina 6.3 mm, to tip of posterior process 5.2 mm, width across tips to suprahumeral horns 3.6 mm, at humeral angles 2.9 mm, at eyes 2.4 mm.

Male unknown.

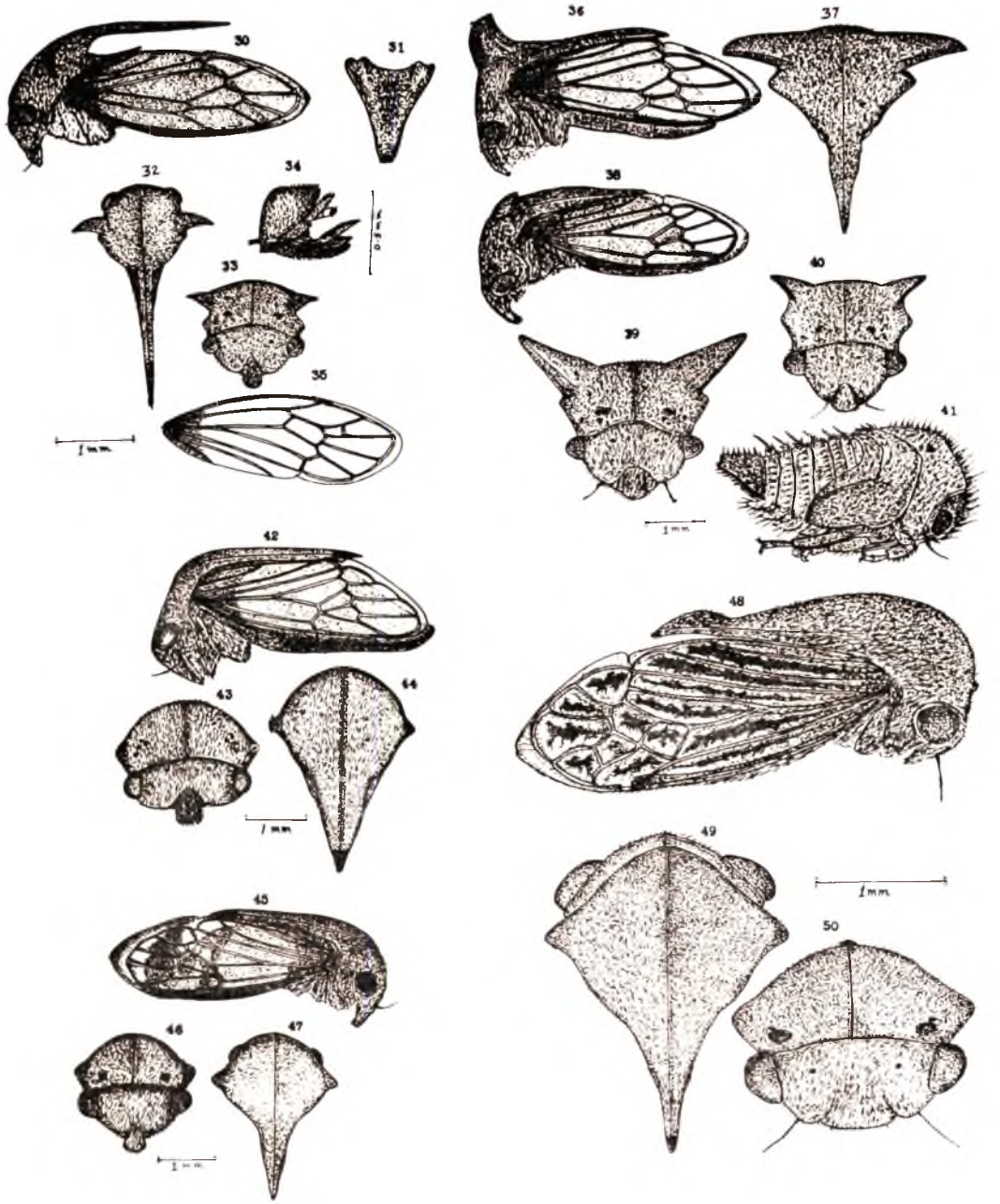
Material examined: Holotype ♀, **paratype** 2 ♀♀, INDIA: KARANATAKA: Bangalore, collected from the host plant, *Artocarpus integrifolia:* 20.i.1979.

Genus *Telingana* Distant 1908.

9. Telingana pulniensis sp. nov. (Figs. 30-.35)

Female: General coloration black. Head vertical about twice as wide as long, finely punctate with short adpressed silvery hairs, upper margin of vertex slightly sinuate; eyes shining black, ocelli silvery white, nearer to eyes than to each other and situated above the centro-ocular lines: frontoclypeus parallel-sided, two-thirds of its length extending below lower margins of vertex, lateral lobes more or less fused, tip broadly rounded with longer pilosity. Pronotum black with shades of dark brown, coarsely punctate, sparsely pilose with silvery hairs; metopidium nearly twice as wide as high, black, strongly convex and obliquely directed backwards, humeral angles short, blunt, not projecting laterad beyond eyes; suprahumeral horns much shorter than width between their bases, viewed from above directed outwards and then backwards, viewed from front directed horizontally laterad and pointed at tip, viewed from sides directed upwards with apex turned backwards: posterior process obliquely elevated from the hindend of disc, slender, tricarinate, directed backwards horizontally, well remote from scutellum, tip acuminate, not impinging on the inner angles of tegmina, reaching about middle of 5th apical cell of tegmina; scutellum longer than wide, coarsely punctate, antero-lateral parts cretaceously sericeous; tegmina hyaline, nearly thrice as long as wide, basal sixth coriaceous and black, veins light brown, 1st apical cell wedge-shaped, twice as long as wide, only one discoidal cell, an inconspicuous cross vein at basal third of 2nd apical cell, apical limbus narrow; lateral areas of thorax white tomentose. Abdomen black beneath and dark brown dorsally.

Measurements: Length from frontal margin to tips of tegmina 4.2 mm, to tip of



Telingana pulniensis sp. n.; 30–lateral view of male; 31–scutellum; 32–dorsal view of pronotum of male. 33–frontal view of male; 34–genitalia of male; 35–tegmina of female; *Tricentrus nobilis* sp. n.: 36–lateral view of female; 37–lateral view of male; 38–dorsal view of pronotum of female; 39–frontal view of female; 40–frontal view of male; 41–lateral view of fifth instar nymph. *Gargara pellucida* sp. n.: 42–lateral view of female; 43–frontal view; 44–dorsal view of pronotum. *Gargara pulniensis* sp. n.: 45–lateral view of female; 46–frontal view; 47–frontal view of pronotum. *Parayasa pilosa* sp.n.: 48–lateral view of female; 49–dorsal view of pronotum; 50–frontal view.

posterior process 3.4 mm; width across tips of suprahumeral horns 2.2 mm; at humeral angles 1.9 mm, at eyes 2.0 mm.

Male: Similar to female in general coloration; tegmina with a single discoidal cell; genitalia as in figure.

Measurements: Length from frontal margin to tips of tegmina 4.1 mm, to tip of posterior process 3.35 mm; width across tips of suprahumeral horns 2.1 mm, at humeral angles 1.8 mm., at eyes 1.8 mm.

Material examined: Holotype ♀, **allotype** ♂, **paratypes** 2 ♀ ♀ 3 ♂ ♂, INDIA: TAMIL NADU: Pulney Hills (6,000 feet) 11.iv.1977.

Remarks: *Telingana pulniensis* is closely related to *consobrina* Dist. (1916) in its general coloration and disposition of horns, but strikingly differs in the presence of a cross vein at the basal one-third of 2nd apical cell in the female and in the single discoidal cell.

Tribe TRICENTRINI

Genus *Tricentrus* Stal 1866

10. Tricentrus nobilis sp. nov. (Figs. 36–41).

Female: General coloration black. Head thickly pilose with golden hairs, nearly twice as wide across extremities of eyes as length of vertex; upper margin of vertex strongly arcuate, lower margins obliquely sloping to frontoclypeus: eyes subglobate, greyish marooned with black; ocelli black, nearer to eyes than to each other and situated on the centro-ocular line; frontoclypeus extending to half of its length below lower margins of vertex, its lobes fused. Pronotum black, finely punctate, thickly pilose with golden hairs; metopidium vertical, 2.25 times wider than high, supraocular callosities divided, black, almost bare; humeral angles prominent and blunt, posterior angles obtusely rounded to posterior margins; disc greyish black; suprahumeral horns fuscous in front, robust, nearly 1.5 times longer than distance between their bases, viewed from lateral aspects projecting obliquely forwards with the apices curved backwards, lateral carinae strong, viewed from above moderately broad, apices subobliquely subacute, posterior carinae weak, viewed from front extending outwards and upwards; posterior process robust, contiguous with scutellum, distal half slightly arcuate, tip just reaching the posterior angle of the inner margin of tegmina, dorsal carina percurrent through metopidium. Tegmina amber coloured with light brown veins, thrice as long as wide, 1st apical cell 4 times longer than wide, costal margin bordering the 1st apical cell very thick, 1st discoidal cell not petiolate, equal in length to 2nd discoidal. Scutellum white tomentose laterally. Legs black upto tibiae, tibiae dark brown, tarsi light brown, hind trochanter prominently toothed on the dilated internal surfaces. Abdomen black.

Measurements: Length from frontal margin to tips of tegmina 4.7 mm, to tip of posterior process 3.4 mm; width across tips of suprahumeral horns 3.9 mm; at humeral angles 2.5 mm. at eyes 2.33 mm.

Male: General coloration as in female. Suprahumeral horns much shorter than those of female, less than one half as long as space between their bases, originating below the level of disc, seen from lateral aspects directed upwards and backwards, tips acute. Posterior process robust, a little elevated above the level of disc after its origin, tip never reaching the posterior angles of inner margin of tegmina.

Measurements: Length from frontal margin to tips of tegmina 4.55 mm, to tip of posterior process 2.8 mm; width across tips of suprahumeral horns 2.6 mm., at humeral angles 2.2 mm., at eyes 2.1 mm.

Fifth instar nymph: General coloration grey, with scattered black dots. Body robust, laterally compressed and subcylindrical; head twice as wide as long, cranial tubercles obsolete; vertex with dense tuberculated spines; eyes greyish; ocelli nearer to eyes than to each other and located above the centrocular lines; rostral tip extending to bases of hindcoxae. Thorax greyish, densely pilose with tuberculated spines; metopidium twice as wide as high; supra-humeral buds short; pronotal posterior process extending over three-fourths of the length of mesonotum; wing pads broad, extending to the 5th abdominal segment, with costal angles well demarcated and fringed with a row of tuberculated spines. Abdominal dorsal tubercles inclined backwards and often adpressed to the body, lateral lamellae of abdominal segments 5 to 8 twice as long as wide, each bearing 11 to 14 tuberculated spines besides scattered minute subspines; anal tube one-fifth of the total body-length. Total length of body 4.2 mm.

This dimorphic species is very closely related to *congestus* (Walker) in the general disposition of horns, and in the position of ocelli, but differs in its smaller size and in the presence of a chitinised thickening along the costal margin opposite to the 1st apical cell of tegmina.

Material examined: Holotype ♀, **allotype** ♂, **paratypes** 6 ♀♀ and **nepionotype** fifth instar nymph. INDIA: KARNATAKA: Mysore, 21.ii.1979, from *Boerhavia* sp.

Tribe GARGARINI

Genus *Gargara* Amyot & Serville 1843.

11. Gargara pellucida sp. nov. (Figs. 42–44).

Female: General colour greyish brown. Head about thrice wider across extremities of eyes than length of vertex, densely pilose with golden yellow hairs; upper margin of vertex arcuate, lower margins broadly rounded towards frontoclypeus; eye subglobate, pale yellow; ocelli black, slightly closer to eyes than to each other and situated above the centro-ocular line; frontoclypeus greyish brown, extending nearly one-half of its length below the lower margins of vertex, tip truncate, frontoclypeal lobes entirely fused and fringed with long pale yellow hairs. Pronotum greyish brown, metopidium twice as wide as high, punctate with golden hairs, obliquely directed backwards to dorsum, humeral angles moderately prominent, pale brown, their posterior angles rounded; posterior process arising horizontally from disc, fitting against scutelum and contiguous with tegminal margin, tricarinate, median carina continued on metopidium, tip black and acute, just passing the anal angles of tegmina; scutellum twice as wide as long, deeply excavated, incompletely chitinised in middle, punctate laterally: tegmina hyaline, thrice as long as wide, basal sixth coriaceous, 1st discoidal cell equal in length to the 2nd discoidal and with a short petiole, apical limbus narrow, hyaline. Legs yellowish brown.

Measurements: Length from frontal margin to tips of tegmina 4.4 mm, to tip of posterior process 3.3 mm, width across humeral angles 2.3 mm, at eyes 2.15 mm.

Male unknown.

Material examined: Holotype ♀ and **paratype** 2 ♀♀. INDIA: KERALA: Palghat, 10.x.1973, collected from *Gymnosporia* sp.

Remarks: This species is related to *rustica* Ananthasub. & Ananthak. (1975) in the distinct jet black apical region of posterior process and hyaline tegmina, but distinctly differs in the presence of a short petiole for the 1st discoidal cell which is equal in length to the 2nd discoidal, in the narrow, hyaline apical limbus, and in the absence of tomentosity in the lateral areas of thorax.

12. Gargara pulniensis sp. nov. (Figs: 45-47)

Female: General coloration greyish brown shaded with black on disc and apex of posterior process; head twice as wide as long, upper margin of vertex nearly planate, lower margins broadly sloping to frontoclypeus; frontoclypeus declivous, extending to nearly three-fourths of its length below lower margins of vertex, lateral lobes more or less fused, its tip broadly rounded; eyes reddish brown, subglobate; ocelli dull black, slightly closer to eyes than to each other and situated on the centro-ocular line. Pronotum finely punctate with short golden yellow hairs; metopidium 1.4 times as wide as high, convex at base and then obliquely directd backwards to disc; supra-ocular callosities rather inconspicuously broken, black and bare; humeral angles greysih brown, projecting laterad beyond eyes, tips subacute; posterior process slightly ampliate, greyish brown at middle, tip acuminate, black, extending to the anal angles of tegmina; tegmina thrice as long as wide, basal sixth coriaceous, rest hyaline with a greyish brown transverse fascia across the apical cells, apical limbus broad, shaded with black, its tip acutely rounded, costal margin thickened, a thickening at R1, apical veins slightly curved, 1st discoidal cell not petiolate, equal in length to 2nd discoidal. Legs greyish brown.

Measurements: Length from frontal margin to tips of tegmina 4.7 mm, to tip of posterior process 3.1 mm, width across tips of humeral angles 2.0 mm, at eyes 1.85 mm.

Male unknown.

Material examined : Holotype ♀, **Paratype** ♀, INDIA: TAMIL NADU, Pulni Hills (6,000 feet), 11.iv. 1977.

Remarks: This species is closely related to *albitarsis* Ananthasub. & Ananthak. (1975) in the presence of dark transverse fascia on the tegmina, but differs in the absence of petiole for the 1st discoidal cell, in the position of ocelli on the centro-ocular line, and in the greyish brown colour of the legs.

Tribe COCCOSTERPHINI

Genus *Parayasa* Distant 1916

13. Parayasa pilosa sp. nov. (Figs. 48–50).

Female: General coloration dark brown. Head ochraceous brown, densely pilose with golden yellow hairs, nearly thrice as wide as long, base of vertex broadly planate; eyes subglobate, brownish; ocelli black, nearer to eyes than to each other and situated on the centro-ocular line; frontoclypeus densely longly pilose, its tip truncate, slightly extending below lower margins of vertex; pronotum brown, not tuberculate, finely punctate with long dense golden pilosity; metopidium twice as broad as high, convex, gently sloping back to disc; supraocular callosities large, oval and bare; humeral angles conspicuous; posterior process brown, hairy, closely fitting against scutellum, convex behind disc, apical area strongly compressed and convex, extreme tip reddish, not reaching the posterior angle of the inner margins of tegmina, dorsal carina percurrent through metopidium; scutellum aborted in the middle; tegmina hyaline with yellow tinge, much spotted and suffused with fuscous brown, thrice as long as wide, veins bordered with golden pilosity, costal margin reddish brown, with a distinct pterostigma just behind the level of R1 which is oblique, veins of apical cells curved, 2nd discoidal cell bisected by a spurious vein, apical limbus moderately broad, tip subacute. Hindwings with 3 apical cells. Abdomen dark brown. Legs with coxa and trochanter black, femora ochraceous brown, tibia and tarsus light brown.

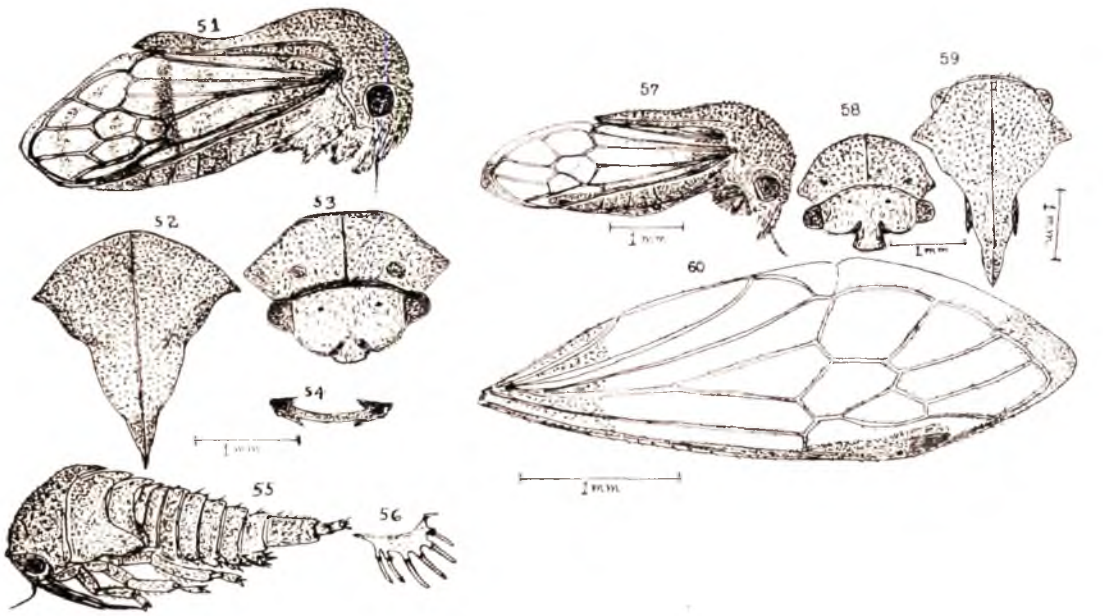
Measurements: Length from frontal margin to tips of tegmina 3.5 mm, to tip of posterior process 2.4 mm, width across tips of humeral angles 1.8 mm, at eyes 1.6 mm.

Material examined: Holotype ♀, INDIA: TAMIL NADU: Sirumalai, 1.viii.1978, Coll. Mr. Swaminathan.

Remarks: This species is closely allied to *maculosa* Distant (1916) in the nature of the posterior process, frontoclypeus and in the much spotted fuscous brown patches on the tegmina, but differs in the presence of a distinct pterostigma.

14. Parayasa fasciata sp. nov. (Figs. 51-56).

Female: General coloration brownish ochraceous. Head ochraceous brown, 2.6 times as wide as long, densely pilose with golden hairs, base of vertex slightly sinuate; eyes subg'obate, fuscous brown: ocelli shining, white, closer to eyes than to each other and situated above the centro-ocular line; frontoclypeus moderately pilose, extending to one-third of its length below lower margins of vertex, tip truncate, frontoclypeal lobes inconspicuous. Pronotum ochraceous brown, finely tuberculate, with short golden pilosity; metopidium twice as wide as high, convex, obliquely sloping backwards to disc, supraocular callosities large-rounded humeral angles conspicuously large, tips acute; posterior process yellowish, its apical area black, closely fitting against scutellum, convexly sinuate, its apex just reaching the posterior angle of the inner margin of tegmina; tegmina palely virescent, 2.6 times as long as wide, basal sixth coiraceous, a fuscous transverse fascia at about the middle, apical limbus narrow, tip subacute, R1 obliquely joining costal margin which shows a weakly chitinised thickening opposite to 1st apical cell, 2nd discoidal cell divided, apical areas straight. Abdomen dark brown.



Parayasa fasciata sp.n.: 51–lateral view of female; 52–dorsal view of pronotum; 53–frontal view; 54–Scutellum; 55–lateral view of fifth instar nymph; 56–an abdominal lateral lamella of fifth instar nymph. *Parayasa nigrolimbata* sp.n.: 57–lateral view of female; 58–frontal view; 59–dorsal view of pronotum; 60–tegmina.

Legs black in femora, lighter in tibiae; tarsi light brown.

Measurements: Length from frontal margin to tips of tegmina 3.9 mm, to tip of posterior process 2.8 mm, width across tips of humeral angles 2.0 mm, at eyes 1.6 mm.

Male: Smaller than female; general coloration dark brownish ochraceous; tegmina smoky brown with a broad fascia near the middle; apical limbus tinted with black.

Measurements: Length from frontal margin to tips of tegmina 3.4 mm, to tip of posterior process 2.72 mm, width across tips of humeral angles 1.9 mm, at eyes 1.5mm

Fifth instar nymph: Body length 3.0 mm. General coloration pale yellowsih brown. Body laterally compressed. Head declivous, cranial tubercles persistent, rostral tip reaching the 1st abdominal segment; eyes reddish brown; ocelli inconspicuous; thorax slightly shorter than andomen excluding anal tube; pronotum with scattered tuberculated spines; metopidium obliquely directed backwards, pronotal posterior process about the length of mesonotum; wing pads extending back to third abdominal segment, costal angles rather inconspicuous, lateral lamellae of abdominal segments 3–8 bearing 6 penicillate spines each, as in *Coccosterphus;* stal (1869) anal tube about one-sixth as long as total length of body.

Material examined: Holotype ♀**, allotype** ♂, **paratypes** 6 ♀ ♀ and 2 ♂ ♂, nepionotype V instar nymph. INDIA: TAMIL NADU: Dimbam forest, 22.ii.1979.

Remarks: *P. fasciata* is of interest in having fine tubercles as in the genus *Coccosterphus* though the tubercles are less prominent than in the latter genus. The nymphal characters, particularly the abdominal lateral lamellae, also resemble those of *Coccosterphus.* It may not be out of place to mention here that the genus *Coccosterphus* Stal is closely related to *Parayasa,* and there is such an almost complete intergradation and overlapping of characters that it would be desirable to include the latter genus in the former.

15. Parayasa nigrolimbata sp. nov. (Figs. 57–60).

Female: General coloration black; Head 3 times as wide as long, sprinkled with short adpressed golden pilosity, vertex twice as wide as long, upper margin sinuate, lower margins broadly rounded towards frontoclypeus; eyes subglobate, ochraceous brown; ocelli black, rather nearer to eyes than to each other and situated above the centro-ocular line; frontoclypeus dark brown, densely pilose, extending to about two-thirds of its length below lower margins of vertex, tip truncate; frontoclypeal lobes small. Pronotum black, metopidium convex, nearly 1.5 times as wide as high, gradually sloping back to disc, finely granulate and sprinkled with long golden pilosity, humeral angles moderately short, tips blunt; posterior process arising horizontally from disc, fitting tightly against scutellum and contiguous with tegmina, tip reaching the 1st anal cell, median carina finely continued through metopidium. Scutellum aborted in the middle. Tegmina hyaline, nearly thrice as long as wide, basal fifth coriaceous, veins light pinkish and hairy, apical limbus black, moderately broad, tip broadly rounded costal margin thickened, the thickening extending into the 1st apical cell and terminating in a club-shaped chitinised lobe or incipient pterostigma, 1st discoidal cell petiolate, 5th apical cell large. Abdomen black. Legs with coxae and trochanters dark brown, femora light brown, tibiae and tarsi yellowish.

Measurements: Length from frontal margin to tips of tegmina 4 mm, to tip of posterior process 2.8 mm; width across tips of humeral angles 1.9 mm; at eyes 1.8 mm.

Male unknown.

This species differs from all other known species of the genus in the presence of an incipient pterostigma formed by the club-shaped chitinised lobes from the costal margin.

Material examined : Holotype ♀, INDIA: KARNATAKA: Coorg, 19.ii.1979, from *Gymnosporia* sp.

Acknowledgements :—Grateful thanks are due to Dr. T.N. Ananthakrishnan, Director, Zoological Survey of India, and to Mr. A.L. Capener of the Plant Protection Research Institute, Pretoria (Retd.) for their valuable suggestions. He is also grateful to the ICAR for the garnt-in-aid, during the tenure of which this work was carried out.

REFERENCES

ANANTHASUBRAMANIAN, K.S. & T.N. ANANTHAKRISHNAN (1975) Taxonomic, Biological and ecological studies of some Indian membracids (Insecta : Homoptera). Pt. I. *Rec. Zool. Surv. India.*, **68**: 161–272.

AMYOT, C.J., & A. SERVILLE (1843) *Histoire Naturelle des Insectes : Hemipteres*, 533–553.

BUCKTON, G.B. (1903) *A monograph of the Membracidae*, 181–296.

CAPENER, A.L. (1962) Taxonomy of the African Membracidae. Pt. I. Oxyrhachinae. *Repub. S. Afr. Dep. Agr. Serv. Ent. Mem.*, **6**: 1–164.

CAPENER, A.L. (1968) Taxonomy of the African Membracidae. Pt. II. Centrotinae. *Repub. S. Afr. Dep. Agr. Serv. Ent. mem.*, **17**: 1–123.

DISTANT, W.L. (1908) *The fauna of British India including Ceylon and Burma. Rhynchota, Homoptera*, **4**: 1–501.

DISTANT, W.L. (1916) *The fauna of British India including Ceylon and Burma*, Appendix, **6**: 1–248.

FABRICIUS, J.C. (1898) Ryngota, Os Rostro : Vagina articulata. *Supplementum Entomologiae Systematicae*. 511–524.

GERMAR, E.F. (1835) Species Membracidum Musae E.F. Germani. *Rev. ent. Silbergmann*, **3**: 223–262.

STAL, C. (1866) Hemiptera Homoptera Latr. *Hemiptera Africana*, **4**: 1–276.

STAL, C. (1869) Hemiptera Fabriciana. Fabricianska Hemipterarter, efter de i Kopenhamn och Kiel forvarade typexemplaren granskade och beskrifne, 2. *Svenska Vetensk. Akad. Handl.*, **8** (1): 1–130.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 129 *to* 134

FURTHER ADDITION TO *DROSOPHILA* FAUNA OF DARJEELING, INDIA

J. P. GUPTA & Y. N. DWIVEDI
Genetics Laboratory, Department of Zoology,
Banaras Hindu University, Varanasi, India 221 005

(*Received 10 September 1979*)

Taxonomic account of four new species namely *D. maryensis*, *D. setitarsa*, *D. novazonata* and *D. para zonata* belonging to subgenus *Drosophila* of the genus *Drosophila* is provided.

(*Key words : new Drosophila* **species**)

Darjeeling, a hill station in West Bengal, is situated at an elevation of 2123 metres above sea level. Until recently very little has been known about the drosophilid fauna of this region. DUDA (1923) described a new species, *D. bipectinata* from Darjeeling. JHA, MISRA & SINGH (1971) recorded seven common species from this region: *D. melanogaster, D. ananassae, D. bipectinata, D. malerkotliana, D. kikkawai, D. busckii* and *D. quadrilineata* (=*Chaetodrosophilella quadrilineata*). GUPTA & SINGH (1977) recorded four species, of them *D. kurseongensis* and *D. neoelegans* were described as new, while *D. trilutea* and *D. lucipennis* recorded for the first time from India. Recently DWIVEDI (1979) described two more new species, *D. guptai* and *D. ramamensis* from areas near Darjeeling.

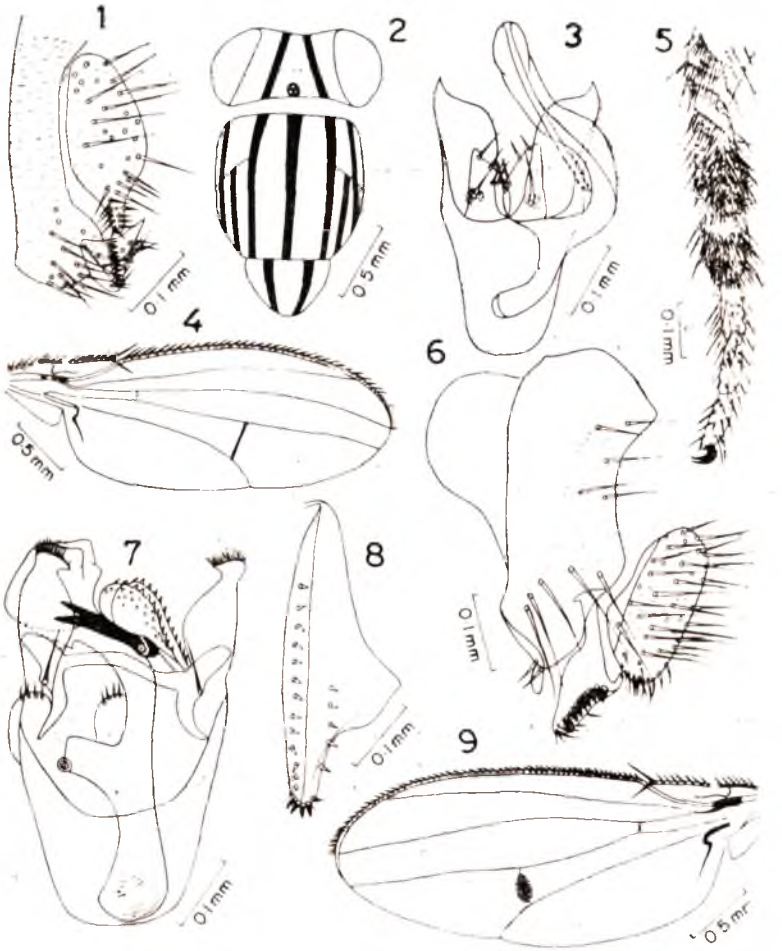
This paper embodies the results of a recent survey made at two different places namely Kurseong (30 km towards south from Darjeeling; alt. 1475 m) and Ramam (75 km towards north from Darjeeling; alt. 2520 m) in Darjeeling district.

1. **Drosophila (Drosophila) maryensis** sp.nov.

Male : Arista with 5 branches above 2 below in addition to terminal fork. Antennae with second segment brown; third segment pale. Frons yellow, ocellar triangle with two dark brown longitudinal stripes. Orbitals in ratio 6:4:6. Vibrissa large, arising from a dark brown spot; second oral bristle thin, about half length of vibrissa. Palpus dark brown, with one prominent apical bristle. Carina pale yellow and high. Face brown. Cheek yellowish, greatest width of cheek 1/7 greatest diameter of eye. Eyes bright red.

Acrostichal hairs regular, in 6 rows. Anterior scutellars convergent; posterior scultellars crossed. Anterior dorsocentral about 3/4 length of posterior dorsocentral; distance from anterior dorsocentral to posterior dorsocentral about half distance between first two dorsocentrals. Mesonotum shining yellow, with 7 longitudinal dark brown stripes; inner stripe of outer pair on either side interrupted at suture. Scutellum with two dark brown stripes (Fig. 2). Thoracic pleura shining yellow, with 3 dark brown stripes. Sterno-index 0.78. Legs yellow, forefemora with 10–11 small spinules; preapicals on all three tibiae; apicals on first and second tibiae.

Wings (Fig. 4): clear, posterior cross vein slightly fuscous. Indices: C-index 4.0; 4V-index 1.43; 4C-index 0.58; 5x-index 1.0. Two setae at the apex of first costal section; heavy setae on about basal 1/3 of



Figs. 1–4, *Drosophila maryensis* sp. nov.: 1–periphallic organs; 2–male head and thorax, dorsal aspect; 3–phallic organs; 4–male wing. Figs. 5–9, *Drosophila setitarsa* sp. nov.:5–male foreleg; 6–periphallic organs; 7–phallic organs; 8–egg-guide; 9–male wing.

third costal section. Haltere's knob yellow, dorsal surface of stalk dark brown.

Abdomen shining yellow, tergites with narrow apical dark bands interrupted medially and laterally.

Length of male body (2 males): 3.34 mm.

Periphallic organs (Fig. 1): Epandrium yellow, pubescent, narrow and broadly rounded below, upper portion of epandrium bare; lower portion with 14 setae. Surstylus triangular, with 10 black teeth arranged in a straight row; 3–4 discal setae, and with 8–9 setae scattered on outer margin. Cerci large, narrowly projected ventrally, pubescent, with 26 long setae dorsally and 13 short stout setae ventrally.

Phallic organs (Fig. 3): Aedeagus yellow, large, curved, apically swollen, with 10–12 serrations mediolaterally, basal apodeme small, about 1/3 as long as aedeagus; small vertical rod developed. Anterior gono-

pophyses conical, with 4 sensilla. Posterior gonopophyses obscure. Caudal margin of novasternum with a pair of large submedian spines. Ventral fragma nearly quadrate.

Holotype ♂, INDIA: WEST BENGAL; St Mary's Hill, Kurseong, Darjeeling district. June-July 1976 (Gupta & Dwivedi).

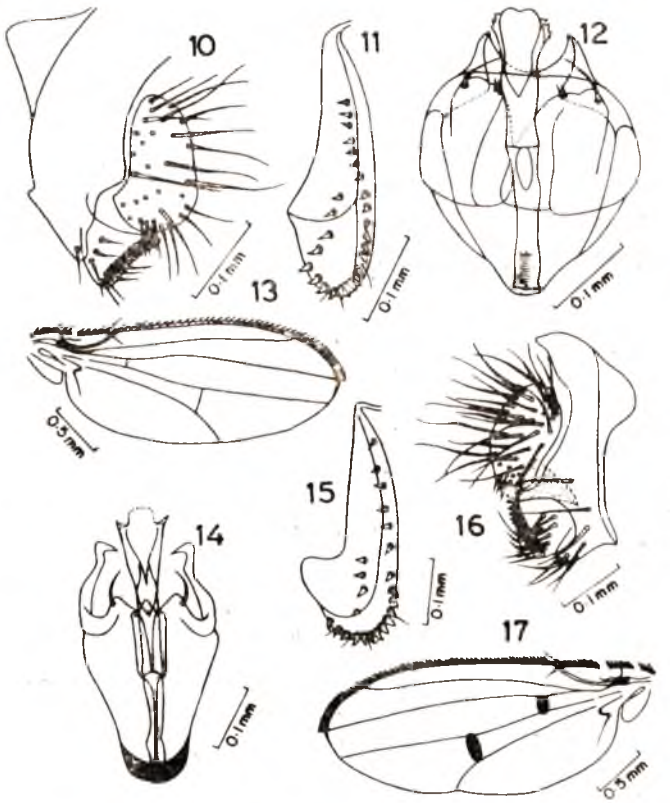
Paratypes: 2 ♂♂, same locality and collectors as holotype. Deposited in the Department of Zoology, Banaras Hindu University, Varanasi, India.

Distribution: India.

Remarks: A row of short spinnules on the inner surface of forefemur suggests its inclusion in the *immigrans* group. It closely resembles *D. annulipes* Duda in having striped mesonotum, but distinctly differs from it in having legs without darker bands, cerci narrowly projected ventrally, and aedeagus with 10–12 serrations mediolaterally.

2. Drosophila (Drosophila) setitarsa sp. nov.

Male and female: Arista with 4–5 branches above and 2 below in addition to terminal fork. Antennae with second segment brown; third segment slightly darker. Frons including ocellar triangle yellowish brown. Orbitals in ratio 9:4:12. Second oral seta thin, about 2/3 length of vibrissa. Palpus pale yellow, with one apical and 1–2 marginal setae. Carina narrow and high Face yellowish brown. Cheek pale, greatest



Figs. 10—13, *Drosophila novazonata* sp. nov.: 10-periphallic organs; 11-egg-guide; 12-phallic organs; 13-male wing. Figs. 14—17, *Drosophila parazonata* sp. nov.: 14-phallic organs; 15-egg-guide; 16-periphallic organs; 17-male wing.

width of cheek 1/6 greatest diameter of eye. Clypeus brown. Eyes dark red.

Acrostichal hairs regular, in 6 rows. Anterior scutellars parallel; posterior scutellars crossed. Anterior dorsocentral 5/7 length of posterior dorsocentral; distance from anterior dorsocentral to posterior dorsocentral about 1/3 distance between first two dorsocentrals. Mesonotum yellowish brown, scutellum slightly darker. Thoracic pleura pale, middle sternopleural bristle as long as anterior sternopleural. Sterno-index 0.56. Legs yellow, inner surface of forefemora with a row of 8–9 short stout spinnules; fore metatarsal and second tarsal segments of male with dense cluster of fine setae (Fig. 5). Preapicals on all three tibiae; apicals on first and second tibiae.

Wings (Fig. 9); clear, posterior cross veins clouded. Indices: C–index 3.55; 4V– index 1.27; 4C–index 0.6; 5X–index 1.23. Two equal setae at the apex of first costal section; heavy setae on basal half of third costal section. Halteres yellow.

Abdominal tergites shining yellow, with medially interrupted narrow dark bands.

Length of male body (2 males): 3.27 mm.

Length of female body (2 females): 3.9 mm.

Periphallic organs (Fig. 6): Epandrium pale yellow, broad, pubescent, narrowing ventrally like a tubular process at toe and with 2 fine setae, upper portion with 5 small setae; lower portion with 5 long black setae. Surstylus large, distally broadened, with 7 stout black and 2 yellowish teeth arranged in a concave row, and with 6–7 fine setae along outer margin. Cerci oval, pubescent, with 33 long setae and a few short setae ventrally.

Phallic organs (Fig. 7): Aedeagus yellowish brown, robust, apically broadened, subapically with paired flap like structures bearing several small conical projections, and a pair of large, stout spines, basal apodeme of aedeagus somewhat compressed laterally, with small vertical rod. Anterior gonopophyses large, with 4 apical sensilla. Caudal margin of novasternum with a pair of long submedian spines. Ventral fragma broad.

Egg–guide (Fig. 8): Lobe pale yellow, narrowing at tip, with 18 marginal and 5 yellowish brown discal teeth. Basal isthmus narrow and short.

Holotype ♂, INDIA : WEST BENGAL; St. Mary's Hill, Kurseong, Dargeeling district, June–July 1976 (GUPTA & DWIVEDI). **Paratypes:** 2♂♂, 3♀♀, same locality and collectors as holotype. Deposited in the Department of Zoology, Banaras Hindu University, Varanasi, India.

Distribution: India.

Remarks: This species also possesses a row of spinules on the inner surface of forefemur, characteristic of the *immigrans* group. It is closely allied to *D. obscuricornis* (de Meijere) in having foremetatarsal segment with dense cluster of fine hairs, but differs from it in having unstriped mesonotum, posterior crossvein largely fuscous and surstylus with 9 stout teeth instead of 4–5 long bristles as in *D. obscuricornis*.

3. Drosophila (Drosophila) novazonata sp. nov.

Male and female: Arista with 4 branches above and 2 below in additon to terminal fork. Antennae with second segment brown; third segment large, reddish brown. Frons including ocellar triangle dark brown. Orbitals in ratio 6:4:9. Second oral seta subequal to vibrissa. Palpus yellowish

brown, with one apical and 2 subapical bristles. Carina dark brown, narrow and high. Face and cheek dark brown, greatest width of cheek 1/5 greatest diameter of eye. Clypeus brown. Eyes bright red.

Acrostichal hairs regular, in 6 rows. Anterior scutellars parallel; posterior scutellars crossed. Anterior dorsocentral 2/3 length of posterior dorsocentral; distance from anterior dorso-central to posterior dorsocentral about half distance between first two dorsocentrals. Mesonotum and scutellum unicolorous, yellowish brown. Thoracic pleura brown. Sterno-index 0.57. Legs yellowish brown, preapicals on all three tibiae; apicals on first and second tibiae.

Wings (Fig. 13): clear. Indices: C-index 3.16; 4V-index 1.49; 4C-index 0.71; 5X-index 1.43. Two unequal setae at the apex of first costal section; heavy setae on about basal 2/5 of third costal section. Haltere whitish yellow.

Abdominal tergites yellowish brown; 1-4T with medially interrupted bands, the remainder tergites completely brown.

Length of male body (1 male): 3.2 mm.

Length of female body (3 females): 3.36 mm.

Periphallic organs (Fig. 10): Epandrium brown, somewhat tapering ventrally, upper portion bare; lower portion with one seta. Cerci large, brown, with 30–33 long setae. Surstylus triangular, with 10 stout black teeth arranged in a straight row on outer margin, dorsomedially with three black setae and 5 setae ventrally.

Phallic organs (Fig. 12): Aedeagus yellowish brown, straight, apically swollen, with a few marginal serrations laterally, basal apodeme of aedeagus as long as aedeagus. Anterior gonopophyses large, each with 2 sensilla. Posterior gonopophyses forming a deeply concaved flap resembling bow. Caudal margin of novasternum with a pair of long submedian spines. Ventral fragma broad.

Egg-guide (Fig. 11): Lobe pale yellow, broadly rounded at tip, with 22 marginal and 4 discal teeth. Basal isthmus short.

Holotype ♂, INDIA: WEST BENGAL; Ramam, Darjeeling district, May 1977, Dwivedi & Gupta). **Paratypes:** 1♂, 6♀♀, same locality and collectors as holotype. Deposited in the Department of Zoology, Banaras Hindu University, Varanasi, India.

Distribution: India.

Ramarks: The presence of small anterior reclinate orbital, long second oral bristle and posterior gonopophyses fused to form a broad distal bow suggest its affinity to the *bizonata* group. It resembles *D. trizonata* Okada, but distinctly differs from it in having larger and darker body, surstylus with 10 stout teeth arranged in a straight row, and aedeagus apically swollen, with a few marginal serrations laterally.

4. Drosophila (Drosophila) parazonata sp. nov.

Male and female: Arista with 4 branches above and 2 below in addition to terminal fork. Antennae with second segment brown; third segment yellowish brown. Frons including ocellar triangle yellowish orange. Orbitals in ratio 6:2:9. Second oral seta thin, about half as long as vibrissa. Palpus yellow, with one prominent apical and 3 marginal setae. Carina yellowish brown, high and broadened below. Face and cheek orange brown, greatest width of cheek 1/5 greatest diameter of eye. Eyes dark red.

Acrostichal hairs regular, in 6 rows. Anterior scutellars divergent; posterior

scutellars crossed. Anterior dorsocentral half length of posterior dorsocentral; distance from anterior dorsocentral to posterior dorsocentral 2/3 distance between first two dorsocentrals. Mesonotum yellowish brown, scutellum slightly darker. Thoracic pleura yellowish orange. Sterno-index 0.54. Legs pale, preapicals on all three tibiae; apicals on first and second tibiae.

Wings (Fig. 17): clear, cross veins deeply fuscous. Indices: C-index 3.21; 4V-index 1.55; 4C-index 0.74; 5X-index 1.16. Two equal setae at the apex of first costal section; heavy setae on about basal 2/5 of third costal section. Haltere yellow.

Abdominal tergites brown to black in male, but yellowish brown in female.

Length of male body (2 males): 2.96 mm.

Length of female body (4 females): 3.58 mm.

Periphallic organs (Fig. 16): Epandrium light brown, narrow, upper portion bare; lower portion with 8 setae. Surstylus quadrate, with 13–14 black stout teeth arranged in a slightly convex row, with 8–9 setae dorsomedially and a few setae ventrally. Cerci oval, with 32 long setae and 6–7 short setae ventrally.

Phallic organs (Fig. 14): Aedeagus yellowish brown, straight, broadened apically, with lateral sharp projections. Anterior gonopophyses small, each with an apical sensillum. Posterior gonopophyses obscure. Caudal margin of novasternum with a pair of submedian spines. Ventral fragma triangular.

Egg-guide (Fig. 15): Lobe yellow, broadly rounded at tip, upper margin prominently swollen upward, with 19 marginal and 4 discal teeth. Basal isthmus narrow and long.

Holotype♂, INDIA: WEST BENGAL: Ramam, Darjeeling district, May 1977 (Dwivdi & Gupta). **Paratypes:** 3♂♂, 6♀♀, same locality and collectors as holotype. Deposited in te Department of Zoology, Banaras Hindu University, Varanasi, India.

Distribution: India

Remarks: This species also possesses the characteristics of the *bizonata* group, showing great similarity to the preceding species, *D. novazonata* Gupta and Dwivedi, but differs from it in having both cross-veins largely fuscous triangular ventral fragma, aedeagus with sharp projections laterally and surstylus with 13–14 stout teeth arranged in a convex row.

Acknowledgements :—The authors are grateful to Dr. T. Okada, Emeritus Professor, Department of Biology, Tokyo Metropolitan University, Tokyo, Japan for extending his help in confirming the identifications and to Prof. J.P. Thapliyal, Head of the Zoology Department for providing laboratory facilities. Financial support from the University Grants Commission (JPG) and the Council of Scientific and Industrial Research, Govt. of India (YND) is gratefully acknowledged.

REFERENCES

DUDA, O. (1923) Die orientalischen und australischen Drosphiliden-Arten (Dipteren) des ungarischen National-Museums zu Budapest. *Ann. Mus. Nat. Hung.*, **20:** 24–59.

DWIVEDI, Y.N. (1979) Description of two new species of subgenus *Drosophila* (Drosophilidae: Diptera) from Darjeeling, India. *Proc. Indian Acad. Sci.*, **88B** (4): 299–304.

GUPTA, J.P. & B.K. SINGH (1977) Two new and two unrecorded Indian speices of *Drosophila* (Diptera) from Kurseong, Darjeeling. *Entomollogist's mon. Mag.*, **113:** 71–78.

JHA, A.P., M. MISRA & V.K. SINGH (1971) Abnormal sex ratio in Darjeeling *Drosophila* population. *Drosoph. Inf. Serv.*,

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 135 *to* 140

REDESCRIPTIONS OF *ALLECTUS, DIVITIACUS* AND *LAMPRIDIUS* (HOMOPTERA : CICADELLIDAE) DESCRIBED BY W. L. DISTANT

SHASHIDHAR VIRAKTAMATH & C. A. VIRAKTAMATH
Department of Entomology, University of
Agricultural Sciences, Bangalore, India 560 024

(*Received 19 September 1979*)

Divitiacus **Distant and** *Lampridius* **are redefined.** *Doratulina notata* **(Distant),** *Divitiacus primus* **Distant and** *Lampridius spectabilis* **Distant are redescribed and illustrated.** *Lampridius* **is recorded from Karnataka and Tamil Nadu.**

(*Key words :* **redescription,** *Allectus*, *Divitiacus*, *Lampridius*)

Distant (1918) erected the genera *Allectus, Divitiacus* and *Lampridius* for his species *A. notatus, D. primus* (both from Ootacamund) and *L. spectabilis* (from Burma) respectively. Pruthi (1934) redescribed the female of *D. primus*. Vilbaste (1965), while revising the genus *Aconura* Lethierry, synonymised *Allectus* with *Doratulina* Melichar. However, the male genitalia of members of these monotypic genera are so far unknown. Some genera of the Euscelinae are difficult to recognise without a knowledge of the male genitalia (Oman, 1949; Knight, 1970). Therefore, a revision of the Indian leafhopper genera incuded in the works of Distant (1908, 1916, 1918) is very essential, not only to correctly recognise these genera but also to study their relationships with the genera of other faunal regions. Species of these three genera were collected by the authors during recent field trips in the states of Karnataka and Tamil Nadu. All specimens dealt with in this study are deposited in the Department of Entomology, University of Agricultural Sciences, Bangalore.

Genus *Allectus* Distant

Though Vilbaste (1965) synonymised this genus with *Doratulina* he did not illustrate the male genitalia. The typical aedeagus, style, structure of head and elongate ovipositor support this synonymy.

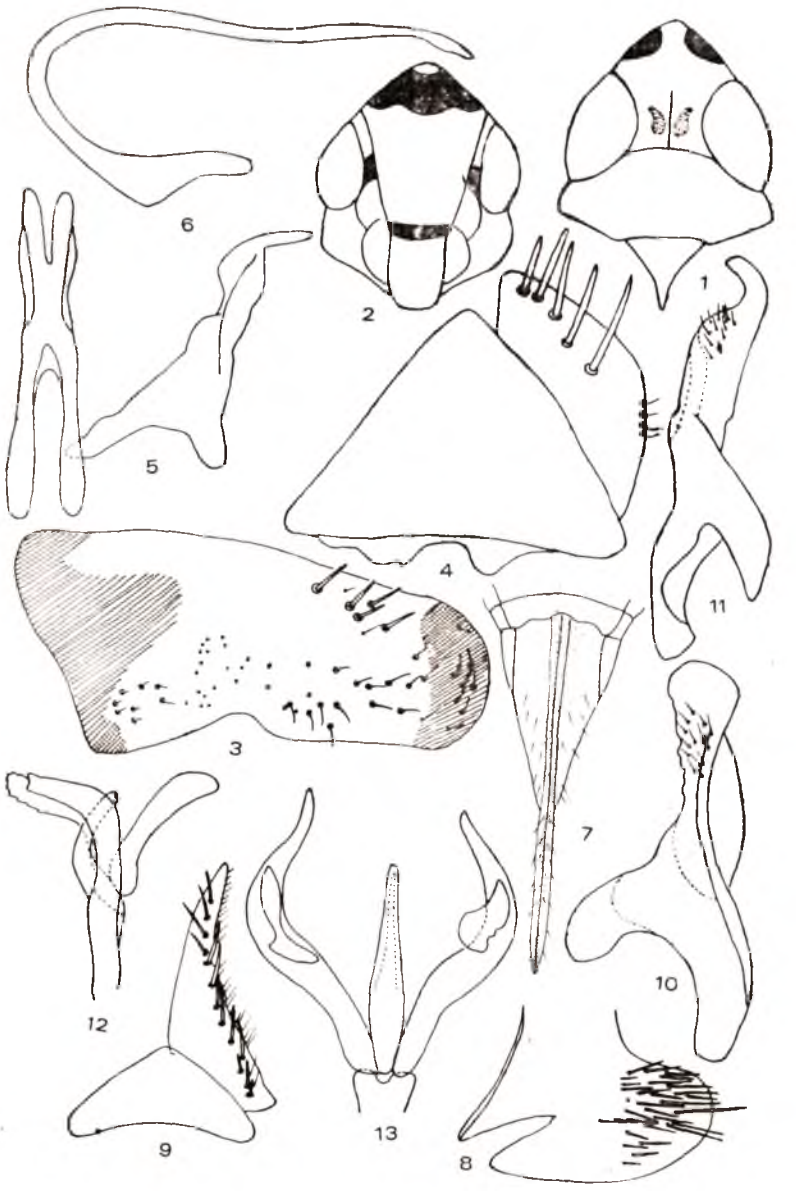
1. **Doratulina notata** (Distant) (Figs. 1–7)

Allectus notatus Distant, 1918 : 76

Doratulina notata : Vilbaste, 1965 : 10

Iridescent green in life. Coloration of preserved specimens as described by Distant (1918) with following additions. A spot at base of antenna, clypo-clypellar sulcus; a transverse band on disk of pronotum in a few specimens; meso- and metathoracic pleura, abdominal terga and sterna except broad lateral and narrow posterior margin and apices of male pygofer black; posterior and lateral areas of abdominal segments ochraceous; male valve dark brown.

Vertex longer than the width between eyes, with a median sulcus and two depressed areas on either side at base; disc basally polished and apically shagreened. Face longer than wide, shagreened. Clypellus wider at base. Anterior half of pronotum gibbous, polished, posterior half flat; 2.13 to 2.31 times as wide as long. Scutellum shorter than pronotum. Forewing without appendix, with 3–4 short apical cells and



Figs. 1—7, *Doratulina notata:* 1-Head and thorax; 2-Face; 3-Pygofer, lateral view; 4-Valve and plate, ventral view; 5-Style and connective; 6-Aedeagus; 7-Ovipositor. Figs. 8—13, *Divitiacus primus:* 8-Pygofer, lateral view; 9-Valve and male plate, ventral view; 10-Style, dorsal view; 11-Style, lateral view; 12-Aedeagus, lateral view; 13-Aedeagus, caudal view.

three subapical cells of which the outer one is the shortest and the inner one is open behind. Spinulation of the hind femur 2+1+1.

Female genitalia:

Seventh sternum as long as sixth with slightly concave and sinuate posterior margin (Fig. 7). Ovipositor about twice as long as pygofer. Both covered by stiff setae.

Male genitalia:

Pygofer elongate with macrosetae but lacks the tubercle on the lobe. Valve triangular. Plates short with uniseriate setae along the lateral margins. Anal collar simple. Connective H-shaped with distal arms shorter than proximal arms. Apophysis of the style finger-like. Aedeagus broad at base, shaft slender somewhat U-shaped with slightly flared apex. Gonopore apical.

Measurements: Male — 3.8 (3.7–4.1) mm long; 1.02 (0.94–1.07) mm wide across eyes. Female — 5.6 (4.9–6.0) mm long; 1.01 (1.01–1.07) mm wide across eyes.

Material Examined: 31 ♂♂ and 49 ♀♀ – INDIA : TAMIL NADU: Ootacamund, Doddabetta, 8300 ft., 4.vi.1977, C. A. Viraktamath and Shashidhar Viraktamath.

Remarks: This species differs from other species of *Doratulina* by its characteristic coloration, absence of tubercle on the male pygofer and very much elongated ovipositor.

Genus *Divitiacus* Distant

Head slightly wider than pronotum. Vertex little more than half as long as the space between eyes, moderately conically produced anteriorly; disc polished. Antennae long. Pronotum polished, faintly transversely rugose, about half as long as wide. Scutellum as long as pronotum. Forewings more than four times as long as broad with four apical and three subapical cells of which the outer one is laterally open. Hind femoral spinulation 2+2+1.

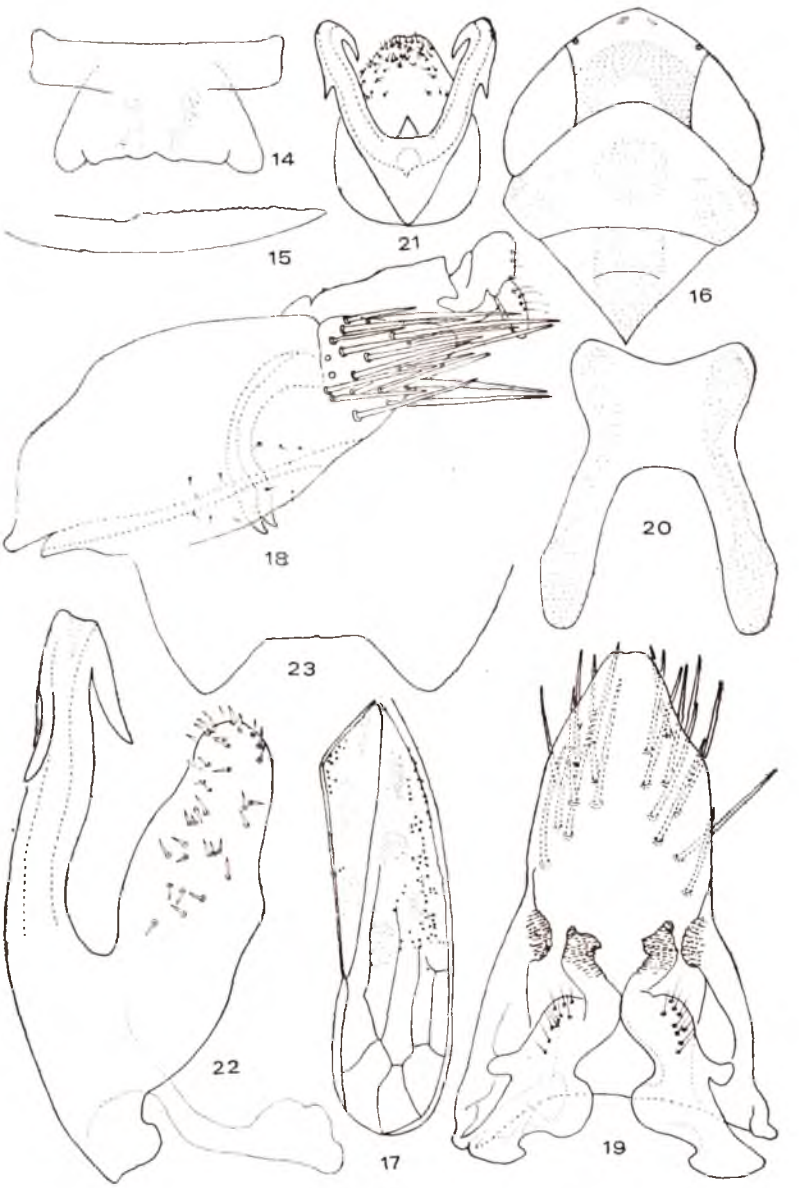
Pygofer simple with a number of setae, without any process. Male plates triangular with uniserial setae and with a number of hair-like setae. Connective Y-shaped. The apophysis of style broad and laminate. Aedeagus with a pair of basal processes to the shaft with which apodemes of anal collar articulate.

2. Divitiacus primus Distant (Figs. 8–15)

Divitiacus primus Distant, 1918 : 59

Coloration as described by Distant (1918) with following additions. Four spots on the anterior margin of vertex either distinct or connected, a fascia on the lower margin of compound eyes continued on the pleural region of prothorax dark brown. In some specimens there is an orange to brown median spot on scutellum. Coloration of the tegmina greatly variable from entirely stramineous to spotted with dark brown or black spots as described by Distant and in some specimens with a subcostal longitudinal fascia or with the cells infuscated with brown and the veins pale and prominent. Dorsum of abdominal segments piceous with lateral broad and posterior narrow ochraceous margins. The sterna variously infuscated with dark brown. Ovipositor dark brown to black. Hindfemora and tibiae with black streaks.

Vertex longer medially than adjacent to the eyes with a median sulcus, disc polished, anterior margin granulated. Ocelli on the margin of vertex several times as away from the eyes as their own diameter. Face finely granulated, wider than long. Clypellus slightly wider at apex than at base. Labrum almost as long as labium. Pronotum 2.09–



Figs. 14—15, *Divitiacus primus:* 14–Female seventh sternum; 15–Second valvula. Figs. 16—23, *Lampridius spectabilis:* 16–Head and thorax; 17–Forewing; 18–Pygofer, lateral view; 19–Valve, plates and styles; 20–Connective; 21–Aedeagus, caudal view; 22–Aedeagus, lateral view; 23–Seventh sternum of holotype female from Burma.

2.35 times as wide as long. Scutellum about as long as pronotum.

Female genitalia:

As illustrated by Pruthi (1934). Seventh sternum basally broad with a median caudally widened sclerite. The latter with lateral and median notches on its hindmargin (Fig. 14). Ovipositor slightly exceeding pygofer. Second pair of valvulae as in Fig.15. Pygofer with stiff setae.

Male genitalia:

Pygofer simple rounded with long setae. Valve triangular. Plate elongate triangular with uniseriate setae and lateral short hair-like setae. Connective Y-shaped, pigmented, with stem widened distally. Style with apophysis broad, laminate and twisted near apex as in Figs. 10 and 11. Aedeagus with a pair of symmetrically curved, apically truncate, basal processes which are much longer than shaft. These processes are articulated at midlength with an apodeme connecting anal collar as in Figs. 12 and 13. Aedeagus tubular, sinuate with apical gonopore.

Measurements: Male—5.21 (5.1–5.4) mm long; 1.28 (1.26–1.32) mm wide across eyes. Female — 5.34 (5.1–5.6) mm long; 1.29 (1.26–1.38) mm wide across eyes.

Material examined :

7 ♂♂ and 33 ♀♀ – INDIA: TAMIL NADU, Ootacamund, Doddabetta, 8300 ft., 4.vi. 1977. C. A. Viraktamath and Shashidhar Viraktamath.

Remarks: Evans (1966) erroneously synonymised *D. primus* Distant with *Deltocephalus coronifer* Marshall. The male genitalia of the two are so distinct that they belong to two different genera.

Genus *Lampridius* Distant

Brightly green and red coloured fragile leafhoppers. Head wider than pronotum, subangularly produced anteriorly. Face longer than broad. Genae sinuate behind eyes. Pronotum half as long as broad with straight hindmargin and smooth lateral margin. Scutellum about as long as pronotum. Forewings translucent with four apical and three subapical cells of which the outer one is narrow and short. Hind-femoral spinulation 2+5+1.

Male pygofer mith a process arising dorsally. Valve and male plates fused to form a single plate with setae. Aedeagus with paired shafts and paired gonopores.

Lampridius appears to be an aberrant member of Opsiini as defined by Emeljanov (1962). It differs from other members of Opsiini in having fused male plates and valve.

3. Lampridius spectabilis Distant
(Figs. 16–23)

Lampridius spectabilis Distant, 1918 : 58

Bright green in life (preserved specimens yellow) with red spots as described by Distant (1918). However, the red spots on wings and scutellum variable. Vertex in a few specimens with two short, dark brown spots near apex.

Vertex polished with a median sulcus. Clypellus slightly narrower in the middle. Frontoclypeus long and narrow. Ocelli on margin of vertex closer to the eyes by a distance less than their own diameter. Face longer than wide. Compound eyes obliquely extend posteriorly over anterior pronotal margin. Pronotum about half as long as wide. Scutellum as long as pronotum. Forewing with four apical and three subapical cells. The apical cells partially infuscated.

Female genitalia :

Seventh sternum slightly concavely curved behind with a median notch (Fig. 23). Ovipositor slightly extending beyond pygofer. Pygofer with numerous long setae.

Male genitalia :

Pygofer elongate, caudally triangularly produced with numerous long setae; a long ventrally directed apically pointed process arising on dorsal wall of pygofer at base of anal collar and crosses over with its counterpart in the middle. Valve and male plates fused to form an elongate, caudally slightly bilobed sclerite with long setae (Fig. 19). Connective U–shaped. Apophysis of the styla sinuately curved, apically transversely rugose. Aedeagus V–shaped with paired shafts and with a membranous dorsal apodeme. Shaft with an anterior ventrally directed apical and a posterior ventrally directed subapical short processes as in Figs. 21 and 22. Gonopore apical.

Measurements : Male – 4.13 (4.0–4.2) mm long; 0.95 (0.94 – 1.01) mm wide across eyes. Female–4.37 (4.3–4.4) mm long and 1.01 mm wide across eyes.

Material examined : 9 ♂♂ and 7 ♀♀ – INDIA : KARNATAKA : 15 km E. Yellapur, 29.ix.1973, C. A. Viraktamath; 1 ♂, INDIA : KARNATAKA : Bannerghatta National Park (15 km S. of Bangalore), 26.i.1975, C. A. Viraktamath and 2♂♂ and 2♀♀ INDIA : TIMIL NADU : Burliar (37 km E. of Ootacamund), 5.vi.1977, Shashidhar Viraktamath.

Acknowledgements :—The authors are indebted to Dr. M.D. Webb, Department of Entomology, British Museum, N.H., London, for comparing *Lampridius spectabilis* with the holotype and for the diagram of the female seveneth sternum of the holotype female (Fig. 23) and to Mr. Kumar D. Ghorpade, Department of Entomology, College of Agriculture Bangalore, for helpful suggestions and improvements of the manuscript.

REFERENCES

DISTANT, W. L. (1908) *Fauna of British India, Rhynchota*. IV. *Homoptera and appendix*. 501 pp. Taylor and Francis.

DISTANT, W. L. (1916) *Fauna of British India, Rhynchota*. V. *Homoptera : appendix*. 248 pp. Taylor and Francis.

DISTANT, W. L. (1918) *Fauna of British India, Rhynchota*. VII. *Homoptera : appendix*. 210 pp. Taylor and Francis.

EMELJANOV, A.F. (1962) New tribes of leafhoppers of the subfamily Euscelinae (Auchenorrhyncha, Cicadellidae). *Ent. Rev.*, **41**: 236–240.

EVANS, J.W. (1966) The leafhoppers and froghoppers of Australia and New Zealand (Homoptera : Cicadelloidea and Cercopoidea). *Mem. Aust. Mus.*, **12**: 1–347.

KNIGHT, W.J. (1970) Two new genera of leafhoppers related to *Hishimonus* Ishihara (Hom., Cicadellidae). *Ann. ent. Fenn.*, **36**: 174–182.

OMAN, P. W. (1949) The Nearctic leafhoppers (Homoptera : Cicadellidae). A generic classification and check list. *Mem. ent. Soc. Wash.*, **3**: 1–253.

PRUTHI, H.S. (1934) Studies on Indian Jassidae. Part II. Description of the genotypes of some of the genera founded by W.L. Distant with a revision of the genus *Moonia* Distant. *Mem. Indian Mus.*, **11**: 69–99.

VILBASTE, J. (1965) On the genus *Aconura* Leth. (Homoptera : Iassidae) *Notul. ent.*, **45** : 3–12.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 141 *to* 150

HITHERTO UNKNOWN MORPHS OF APHIDS (HOMOPTERA : APHIDIDAE) FROM MANIPUR AND NAGALAND, NORTHEAST INDIA

T. K. SINGH, D. RAYCHAUDHURI, S. K. RAHA & D. N. RAYCHAUDHURI
Entomology Laboratory, Department of Zoology,
University of Calcutta, Calcutta, India 700 019

(*Received 30 August 1979*)

Hitherto unknown morphs, viz., alate viviparous female of *Melanaphis vandergooti* Raychaudhuri and Banerjee, apterous oviparous female of *Dactynotus pseudotanaceti* Verma, alate viviparous female of *Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri, alate viviparous female of *Eutrichosiphum* (*Neoparatrichosiphum*) *flavum* (Takahashi), alate oviparous female of *Eutrichosiphum* (*Neoparatrichosiphum*) *raychaudhurii* (Ghosh), alate viviparous and alate oviparous females of *Greenidea* (*Neogreenidea*) *ayyari* Raychaudhuri, Ghosh, Banerjee and Ghosh, alate viviparous female of *Greenidea* (*Trichosiphum*) *quercicola* Basu, Ghosh and Raychaudhuri are reported.

(*Key words :* **hitherto unknown morphs, aphids**)

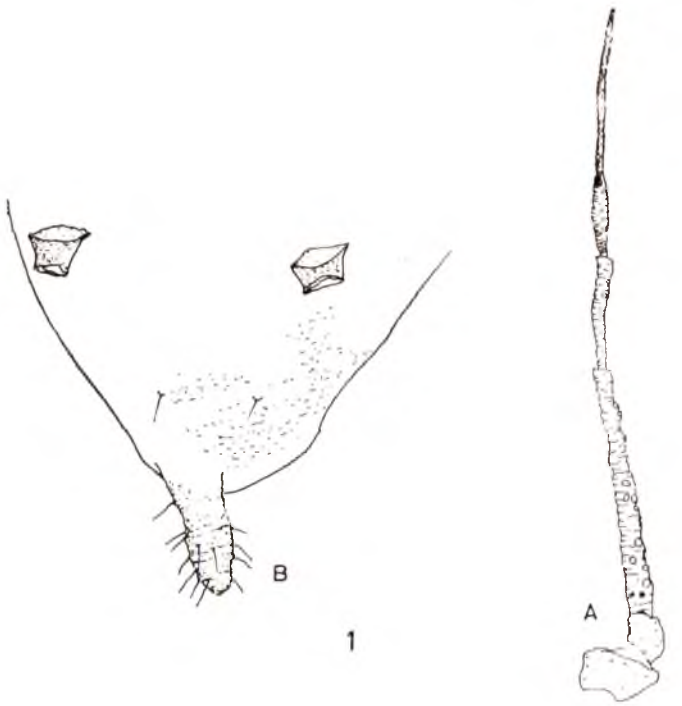
A systematic survey for aphid fauna in Manipur and Nagaland during 1972–1978 has resulted in the collection of hitherto unknown morphs belonging to the subfamilies Aphidinae and Greenideinae. The present paper provides a detailed description of those morphs of the species given below. Besides these, a note on the occurrence of pseudosensoria on the hindfemora of *Schoutedenia lutea* (van der Goot) has also been provided. All the materials are in the collection of Entomology Laboratory, Department of Zoology, Calcutta University.

1. Melanaphis vandergooti Raychaudhuri and Banerjee

Melanaphis vandergooti Raychaudhuri and Banerjee, 1974 *Oriental Ins.*, 8(3): 382.

Alate viviparous female : Body about 1.35–1.70 mm long with 0.55–0.70 mm as its maximum width. Head dark brown; dorsal cephalic hairs long and fine and about 1.50–1.66 × b. d. III. Antennae 6-segmented, dark brown, imbricated, about 0.57–0.68 × body: segment III with 10–14 and segment IV with 1–6 protuberant secondary rhinaria (Fig. 1 A) distributed over entire length; p.t. about 2.14–2.71 × base of last segment; flagellar hairs fine, longest one on segment III about as long as its diameter at base. Rostrum reaching beyond forecoxae; u.r.s. obtuse, about 0.68 – 0.80 × h. t. 2. Abdominal dorsum pale, with dark brown marginal sclerites; dorsal abdominal hairs long and fine, longest one on anterior tergites about 1.10–1.16 × b. d. III; 8th tergite with 2 hairs, these about 1.33–1.50 × b d.III. Siphunculi (Fig. 1 B) dark brown, imbricated, truncated at apex, shorter than its basal width, about 0.02–0.03 × elongated cauda bearing about 13–16 hairs. Wing venation normal; veins rather thick.

Measurements of one alata in mm : Length of body 1.69, width 0.69; antenna 0.98, segments III: IV : V : VI 0.18 : 0.17 : 0.17 : (0.09 + 0.25); u.r.s. 0.06; h. t. 2. 0.08; siphunculus 0.04; cauda 0.18.



1A—*Melanaphis vandergooti* Raychaudhuri and Banerjee : alata : antenna showing secondary rhinaria. 1B—*Melanaphis vandergooti* Raychaudhuri and Banerjee : alata : siphunculi.

Material : 13 apterous, 1 alate viviparous ♀♀ and 5 nymphs from *Panicum paludosum* (Gramineae), 4. vi. 1971, INDIA : MANIPUR : Moriang, 2 apterous and 3 alate viviparous ♀♀ from *Panicum paludosum* (Gramineae), 2.viii.1972, INDIA : MANIPUR : Moriang 2 apterous and 1 alate viviparous ♀♀ from unidentified grass, 29.iv.1976, INDIA : NAGALAND : Dimapur.

Remark : The species was described from apterous viviparous female collected in West Bengal.

2. Dactynotus pseudotanaceti Verma

Dactynotus pseudotanaceati Verma, 1969 p. 136.

Apterous oviparous female : Body about 2.34–2.59 mm long with 1.29–1.36 mm as its maximum width. Head brown and smooth; dorsal cephalic hairs moderately long, stiff with incrassate apices. Antennae 6-segmented, concolourous with head; segments I and II nearly smooth; flagellum imbricated; p.t. broken, segment III with 21–25 strongly protuberant secondary rhinaria (Fig. 2B). distributed almost over its entire length; flagellar hairs long with incrassate apices, longest being about 1.10–1.20 × b.d.III. Rostrum reaching hindcoxae; u.r.s. about 1.13–1.29 × h.t. 2. Midthoracic furca with a short narrow base. Dorsum of abdomen (Fig. 2A) smooth, 8th tergite with a transverse narrow band; dorsal hairs on sclerotic bases moderately long, with incrassate apices; longest hair on anterior tergites, on 7th and 8th tergites about 2.50–2.80, 2.60–3.10 and 3.0 × b.d. III respectively, Siphunculi long, cylindrical, imbricated with apical 0.30–0.33 portion reticulated, without any distinct flange.

Cauda short, elongated with 6–7 hairs. Legs normal; hindtibiae (Fig. 2C) swollen with many pseudorhinaria. F.T.C. 5,5,5.

Measurements of one apterous ovipara in mm: Length of body 2.52, width 1.36; antenna?; segments III:IV:V:VI 0.58:0.43: 0.41: (0.13+?); u.r.s. 0.14; h.t.2 0.11; siphunculus 0.58: cauda 0.23.

Material : 7 apterous, 1 alate viviparous ♀♀, 2 apterous oviparous ♀♀ and few nymphs from *Chrysanthemum* sp. (Compositae), 13.i.1977, INDIA : MANIPUR : Mao,

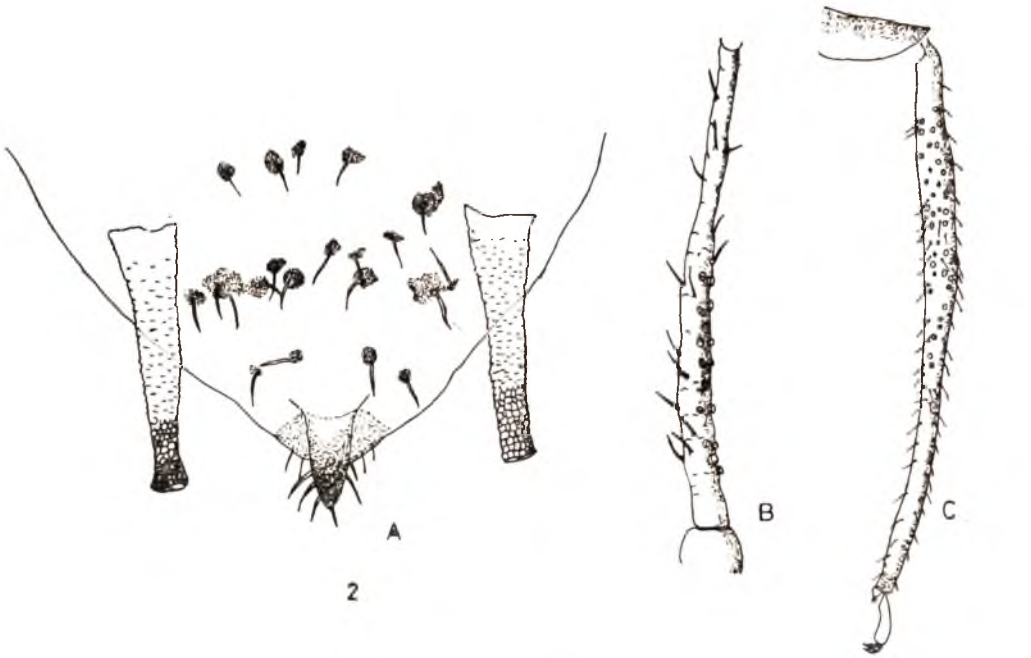
Remark : Verma (1969) recorded this species from Jammu and Kashmir. Till date the species was so far known to occur by apterous and alate viviparous female.

3. **Hydronaphis colocasiae** Raychaudhuri, Raha and Raychaudhuri

Hydronaphis colocasiae Raychaudhuri, Raha and Raychaudhuri, 1977 *Entomon*, 2(1): 74.

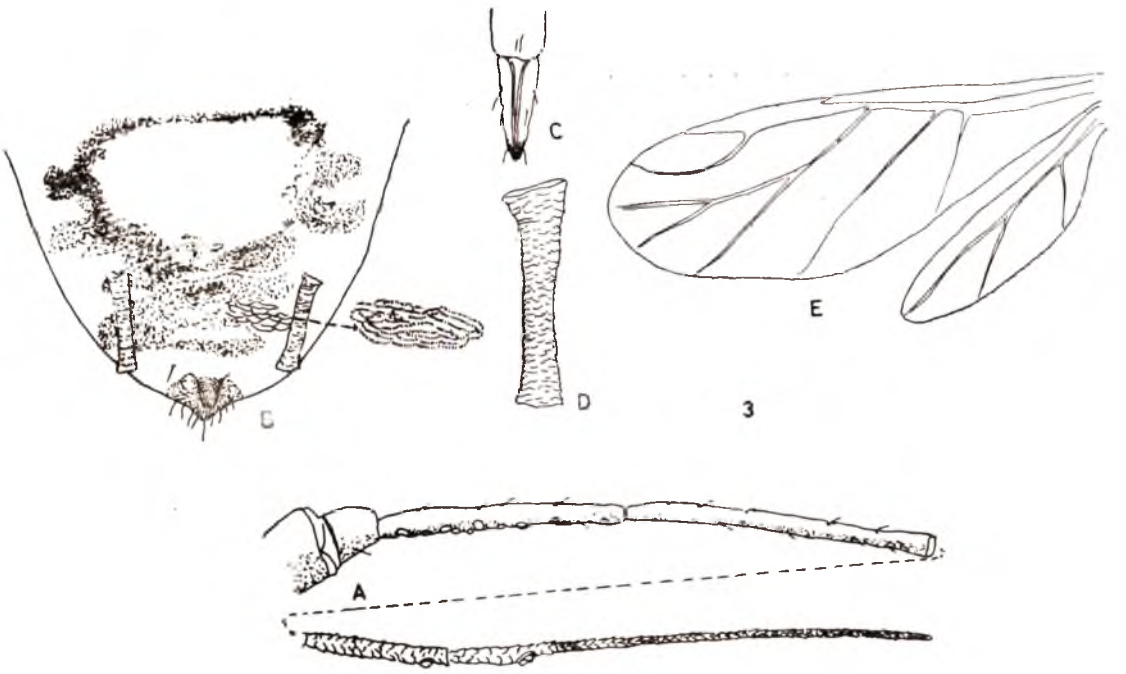
Alate viviparous female: Body about 2.76–2.83 mm long with 0.67–0.71 mm as its maximum width. Head dark brown, anterior portion spinulose both dorsally and ventrally but smooth on posterior margin. Antenae (Fig. 3A) about 1.90–1.96 mm long; segment III with more than 10 thorny hairs; longest one on segment III about 0.60–0.70 × b.d. III; protuberant secondary rhinaria (9–13) only on segment III. Ultimate rostral segment (Fig. 3C) about 1.80–1 90 × h.t. 2. Abdominal dorsum (Fig. 3B) with a large central sclerite extending upto 6th segment besides marginal sclerites on 2nd to 6th segments; segment VII with 8 long, fine hairs and segment VIII with 4 such hairs which are about 1.0–1.20 × b.d. III. Siphunculi (Fig. 3D) about 2.40–3.0 × cauda which bears 5–7 hairs. Media of forewing twice branched and hindwing with two oblique veins (Fig. 3E).

Measurements of one alata in mm: Length of body 2.76, width 1.44; antenna 1.96; segments III: IV: V: VI 0.40 : 0.40:0.25: (0.15 + 0.58); u.r.s. 0.24; h.t. 2 0.13; siphunculus 0.37; cauda 0.13.



2

2A—*Dactynotus pseudotanaceti* Verma : apterous oviparous female : dorsum of abdomen. 2B—*Dactynotus pseudotanaceti* Verma : apterous oviparous female : antenna showing secondary rhinaria. 2C—*Dactynotus pseudotanaceti* Verma : apterous oviparous female : hindtibia showing pseudosensoria.



3A—*Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri : alata : antenna. 3B—*Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri : alata : showing posterior portion of abdomen. 3C—*Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri : alata : ultimate rostral segment. 3D—*Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri : alata : siphunculi 3E—*Hydronaphis colocasiae* Raychaudhuri, Raha and Raychaudhuri : alata : wings.

Material: 10 apterous, 2 alate viviparous ♀ ♀ and 6 nymphs from *Colocasia* sp. (Araceae) 2. xii. 1976, INDIA: NAGALAND : Kohima 8 apterous, 3 alate viviparous ♀ ♀ from *Colocasia* sp. (Araceae), 4. iii. 1977, INDIA : NAGALAND: Tuensurg.

Remark: The species was so far known by apterous viviparous female from Nagaland. The alate viviparous female reported here differs from its closely related species *impatiens* Shinji described from Japan by Takahashi (1965) in ultimate rostral segment being about 1.80–1.90 × h.t.2, bearing 4 secondary hairs, antennal segment III being provided with 9–13 secondary rhinaria and segment IV having no rhinaria.

4. Schoutedenia lutea (van der Goot)

Setaphis luteus van der Goot, 1917 *Contr. Faune Ind. neerl.*, 1(3): 154.

Material: 2 apterous viviparous, 4 apterous oviparous ♀ ♀ and 4 nymphs from an unidentified plant of Rosaceae, 20. vi. 1976, INDIA: MANIPUR. Moriang.

Remarks: David *et. al.* (1956) while reporting apterous oviparous female of this species under the name *Schoutedenia emblica andhraka* stated "hindtibiae not incrassate; pseudosensoria absent or scarce, rather large, roundish." This statement apparently suggests that hindtibiae of this morph is not swollen abruptly to accommodate pseudorhinaria if there are any, as noticed usually in similar morph of other species. Ghosh *et al* (1972) reported the presence of pseudorhinaria on tibiae of the apterous oviparous female of this species. Ghosh *et al.* (1972) though did not mention specifically which tibiae had pseudorhinaria, it can be guessed by tibiae they meant hindtibiae since usually only hindtibiae of

oviparae possess such rhinaria. We had the chance of examining the material reported by Ghosh *et al.* (1972) while trying to compare the material collected from Manipur with their material. To our surprise we found that the hindfemora (Fig. 4) and not the hindtibiae of the oviparous morphs collected from Manipur as well as those reported by Ghosh *et al.* (1972) have pseudorhinaria. So it appears to us that sometimes the oviparae may have pseudorhinaria on hindfemora instead of hindtibiae.

5. Eutrichosiphum (Neoparatrichosiphum) flavum (Takahashi).

Paratrichosiphum flavum Takahashi, 1941 *Govt. Agric. Res. Inst. Taiwan, Rep.*, 78:8.

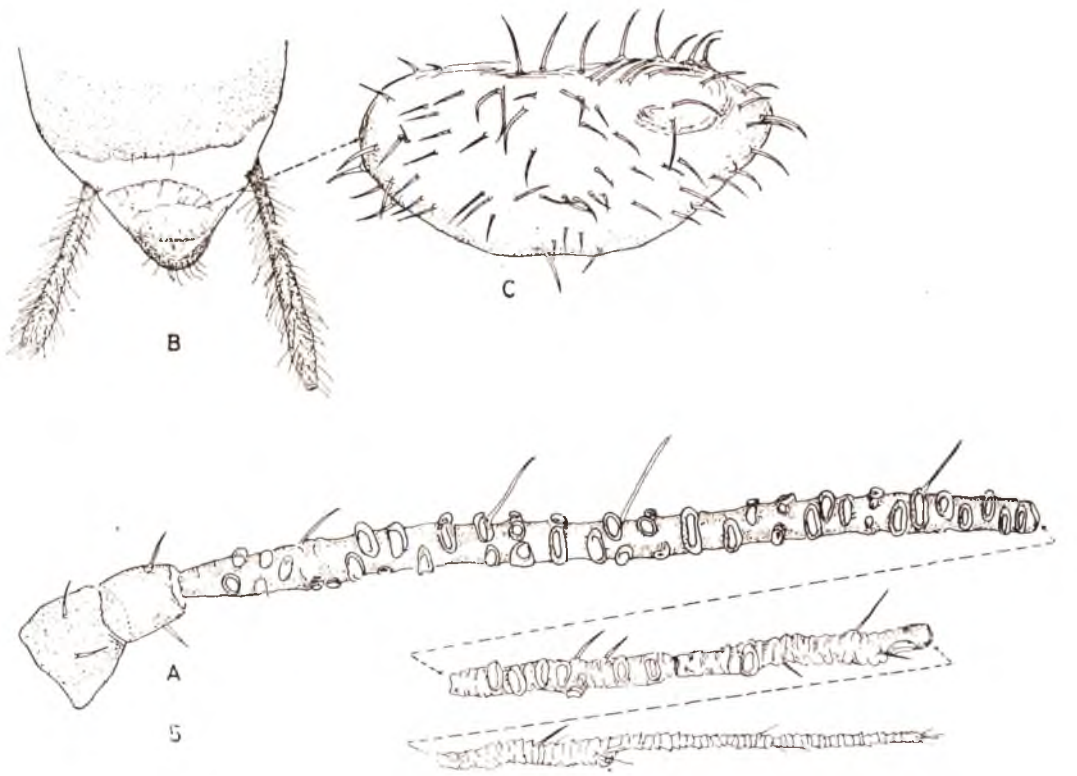
Alate viviparous female: Body about 2.01 mm long with about 0.93 mm as its maximum width. Head pale brown. Antennae 6–segmented, pale brown, about 0.67 × length of body; segment IV faintly imbricated, rest of flagellum gradually more distinctly imbricated; segment III with 40 large, transversely elongate secondary rhinaria distributed irregularly over its entire length, segment IV with 8 such rhinaria also over its entire length; p.t. about 0.83 × base of segment VI; flagellar hairs with acute to acuminate apices, longest hair on segment III about 0.20 × b.d. III. Rostrum reaches hindcoxae; segments 4 + 5 of rostrum about 1.92 × h.t.2 and segment 4 about 6.66 × segment 5 and with about 8 secondary hairs. Abdominal dorsum smooth and with a spinopleural patch on segments 2–4 besides marginal patches on each of segments 1–5; dorsal hairs long with finely drawn out apices; longest hair on anterior tergites about 1.44 ×, on 7th tergite about 2.44 × and on 8th tergite about 3.0 × b.d. III respectively. Siphunculi dark brown, about 0.62 × body, at base about 2.30 × at middle about 3.50 × and at apex about 2.0 × middle diameter of hindtibiae; hairs on siphunculi mostly long with finely drawn out apices. Cauda semi-oval with about 8 hairs. Legs pale brown excepting apical portion of tibiae and whole of tarsi which are more dark; femora with ventral spinulose striae; tibiae smooth excepting spinulose apical portion. Wing–venation normal.

4—*Schoutedenia lutea* (van der Goot) hind-femur showing pseudosensoria.

Measurements of the alata in mm: Length of body 2.01 width 0.93; antenna 1.36, segments III: IV: V: VI 0.57: 0.19: 0.16: (0.16+0.15); u.r.s. (4+5) 0.21; h.t. 2 0.11; siphunculus 0.62.

Material: 4 apterous and 1 alate viviparous ♀♀ from *Quercus* sp. (Fagaceae), 19.iv. 1974, INDIA: MANIPUR: Tuyangwaichong.

Remarks : This species has been previously reported by Ghosh et al. (1971) from Manipur by only apterous viviparous females. From the previous records it appears that in India this species is restricted to north eastern states.



5A—*Eutrichosiphum*'(*Neoparatrichosiphum*) *raychaudhurii* (Ghosh) : alate oviparous female : antenna. 5B—*Eutrichosiphum* (*Neoparatrichosiphum*) *raychaudhurii* (Ghosh) : alate oviparous female : abdominal dorsum showing sclerotic patch. 5C—*Eutrichosiphum* (*Neoparatrichosiphum*) *raychaudhurii* (Ghosh): alate oviparous female : subgenital plate.

6. Eutrichosiphum (Neoparatrichosiphum) raychaudhurii (Ghosh).

Paratrichosiphum (*Neoparatrichosiphum*) *raychaudhurii* Ghosh, 1969, p. 124.

Alate oviparous female: Body about 2.05 mm long with about 0.86 mm as maximum width. Head smooth, strongly sclerotized. Antennae (Fig. 5A) dark brown, 6-segmented, about 0.70 × body, segments I and II smooth; flagellum gradually distinctly imbricated apicad; hairs on flagellum with acute to acuminate apices; longest one on segment III about 3.33 × b.d.III; segments III, IV and V with about 34, 7 and 1 subcircular secondary rhinaria respectively. Rostrum long, reaching beyond midcoxae; u.r.s. with about 8 secondary hairs and about 2.93 × h.t.2; segment 4 about 6.72 × segment 5. Abdomen smooth with a large central sclerotic patch (Fig. 5B); dorsal hairs short and long with acute, acuminate or furcated apices, longest one on anterior tergites, 7th and 8th tergite being about 2.0 ×, 2.33 × and 3.83 × b.d. III respectively. Siphunculi dark brown, basally cylindrical followed by a swollen portion and then abruptly narrowed, with spinular imbrications on distal 0.50 portion, about 0.35 × body, at base about 2.33 ×, at middle about 3.66 × and at apex about 1.66 × middle diameter of hind tibiae; hairs on siphunculi with acute or acuminate apices. Cauda rounded, with many hairs. Subgenital (Fig. 5C) and

subanal plates with many fine hairs. Wing-venation normal, M of forewing not reaching pterostigma.

Measurements of the alate ovipara in mm: Length of body 2.05, width 0.86; antenna 1.44, segments III: IV: V: VI 0.54: 0.18: 0.19: (0.16+0.23); u.r.s. (4+5) 0.26: h.t. 2 0.09; siphunculus 0.16.

Material : 2 apterous viviparous ♀ ♀ and 1 alate oviparous ♀ from *Alnus nepalensis* (Betulaceae), 12.v. 1979, INDIA: MANIPUR: Lamlang.

Remark : Ghosh (1969) described this species from apterous viviparous female occurring in West Bengal. Later Raychaudhuri and Chatterjee (1974) reported alate viviparous female of this species from Sikkim.

7. **Greenidea (Neogreenidea) ayyari** Raychaudhuri, Ghosh, Banerjee and Ghosh

Greenidea (*Neogreenidea*) *ayyari* Raychaudhuri, Ghosh, Banerjee and Ghosh, 1973, Kontyu, 41(1): 63.

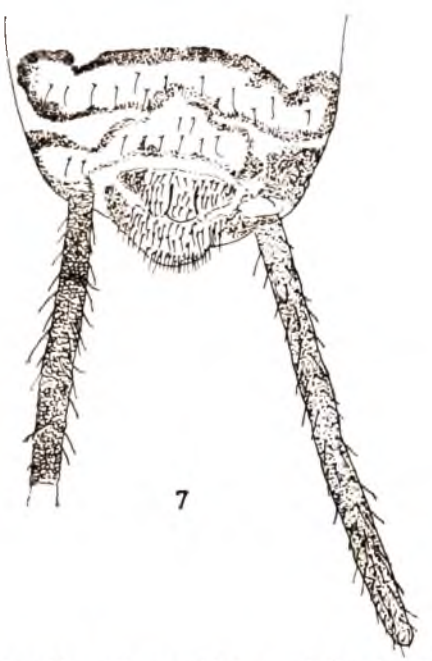
Alate viviparous female: Body about 2.92 mm long with about 1.27 mm as its maximum width. Antennae (Fig. 6) brown, 1.10× body; flagellum imbricated and faintly reticulated on segments IV and V; segment III with 17–19 round, secondary rhinaria distributed over its entire length; p.t. about 2.60 × base of segment VI: flagellar hairs long and short having acuminate to fine apices, longest one on segment III about 5.44 × b.d. III. Rostrum reaching beyond 1st abdominal tergite; segments 4×5 of rostrum about 2.67 × h.t. 2, segment 4 of rostrum about 4.63×segment 5 and with 12 secondary hairs. Abdominal dorsum with a brownish patch on segments 3–5 besides similar patches on segments 1 and 2, tergaits 6 and 7 with separate transverse brownish bands; dorsal hairs long with acute apices,

6.—*Greenidea* (*Neogreenidea*) *ayyari* Raychaudhuri, Ghosh, Banerjee and Ghosh : alate viviparous female: antenna.

longest hair on anterior tergites about 1.78 × b.d.III; each of 7th and 8th tergites with 2 hairs which are about 2.14 × and 2.50 × mentioned diameter respectively. Siphunculi long reticulated over its entire length, apically dark, about 0.76 × body, about 16.30 × its maximum width, width at base about 2.66×, at middle about 2.13× and at apex about 1.33 × middle width of hindtibiae respectively; hairs on siphunculi mostly long and fine, a few shorter ones with similar apices also found. Cauda semioval and bears 6 hairs.

Measurements of the alata in mm: Length of body 2.93, width 1.25; antenna 3.25, segments III: IV: V: VI 0.97: 0.48: 0.44: (0.31 + 0.83); u.r.s. (4+5) 0.33; h.t. 2 0.12; siphunculus 2.26.

Alate oviparous female: (Fig. 7) Body about 2.55 mm long with about 1.27 mm as its maximum width. Antennae brown, 6–segmented, about 1.17 × body; flagellum imbricated and reticulated faintly on segments III and IV; segment III with 18 round secondary rhinaria distributed on basal 0.66 portion; p.t. about 2.47 × base of segment VI. Rostrum reaching hindcoxae; rostral segments 4+5 about 1.97 × h.t. 2, segment 4 about 4.31 × segment 5 and bears 12 secondary hairs. Longest hair on anterior tergites about 2.16 × b.d. III. Siphunculi about 0.90 × body, about 23.0 × its maximum width; longest hair on siphunculi about 4.0 b.d. III. Cauda broadly rounded. Other characters as in alate viviparous female.



7—*Greenidea* (*Neogreenidea*) *ayyari* Raychaudhuri, Ghosh, Banerjee and Ghosh : alate oviparous female: posterior portion of abdomen.

Measurements of the alate oviparous female: Length of body 2.55, width 1.27; antenna 8.0, segments III:IV: V: VI 0.90: 0.48:0.43: (0.29+0.72); u.r.s. (4+5) 0.26; h.t. 2 0.13; siphunculus 2.30.

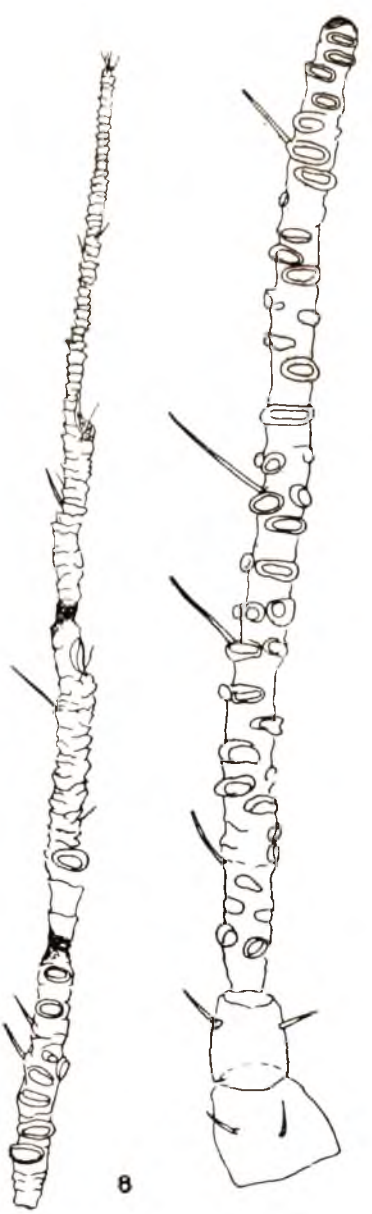
Material: 1 apterous viviparous and 1 alate oviparous ♀ ♀ and 4 nymphs from *Lyonia* sp. (Ericaceae), 15. iv. 1974, INDIA: MANIPUR: Mao, 1 alate viviparous ♀ and 1 nymph from *Quercus* sp. (Fagaceae), 15.iv. 1974, INDIA : MANIPUR: Mao.

Remark: *Greenidea* (*Neogreenidea*) *ayyari* Raychaudhuri, Ghosh, Banerjee and Ghosh was so far known only from West Bengal.

8. Greenidea (Trichosiphum) quercicola Basu, Ghosh and Raychaudhuri.

Greenidea (*Trichosiphum*) *quercicola* Basu, Ghosh and Raychaudhuri, 1973, *Proc. zool. Soc. Calcutta*, **26:** 96.

Alate viviparous female: Body elongated, about 2.54–2.63 mm long and about 1.13–1.16 mm as maximum width. Head brown. Antennae (Fig. 8) 6–segmented, about 1.02–1.04 × body; segment III with 12–14 transversely oval secondary rhinaria arranged in a row; p.t. about 2.40–2.60 × base of



8—*Greenidea* (*Trichosiphum*) *quercicola* Basu, Ghosh and Raychaudhuri : alate viviparous female : antenna.

antennal segment VI; flagellar hairs short to long with acuminate apices, longest one on segment III about 3.15–3.25 × b.d. III. Rostrum reaching 2nd abdominal segment; rostral segments 4+5 about 3.10—3.33 × h.t.2, segment 4 about 4.70–5.11 × segment 5 and with about 10 secondary hairs. Abdominal dorsum with brownish transverse bands on tergites 2–6; dorsal abdominal hairs with acute to acuminate apices; longest hair on anterior tergites about 1.70–1.85 × b.d.III; 7th tergite with 2 fine hairs, these being about 1.80–2.10 × b.d. III; 8th tergite also with such hairs which are about 2.0–2.16 × the mentioned diameter. Siphunculi pale with apical portion dusky, about 0.62–0.63 × body, about 17.0–23.40 × its maximum width; width at base about 2.30–3.0 ×, at middle about 2.66–3.0 × and at apex about 1.66–2.0 × middle diameter of hindtibiae; hairs on siphunculi numerous, mostly long with acute to acuminate apices. Cauda with a median stylus and bears 8 hairs. Tibiae with striate imbrications. Wing-venation normal.

Measurements of one alate in mm. : Length of body 2.59, width 1.19; antenna 2.70, segments III : IV: V: VI 0.70 : 0.41 0.41 : (0.27+0.72); u.r.s. (4+5) 0.34; h.t. 2 0.10; siphunculus 1.62.

Material: 3 apterous, 2 alate viviparous ♀♀ and 3 nymphs from *Quercus* sp. (Fagaceae), 19.iv.1974, INDIA : MANIPUR : Tuyang-waichong.

Remark: The species was so far known to be restricted to Sikkim.

Acknowledgements :—Authors are thankful to University Grants Commission for partly financing the project, to the Botancial Survey of India for kindly identifying some of the plant material and to the Head of the Department of Zoology for providing laboratory facilities.

REFERENCES

DAVID, S.K. & D. HILLE RIS LAMBERS (1956) Notes on south Indian. Aphids. II. Sexual forms in *Schoutedenia* RUBS. *Indian J. Ent.*, **18**(1): 41–44.

GHOSH, A.K. (1969) New aphids (Insecta : Homoptera) from North Bengal, India. *Proc. zool. Soc. Calcutta*, **22**: 121–127.

GHOSH, A.K., H. BANERJEE & D.N. RAYCHAUDHURI (1971) Aphid species collected from Manipur and Nagaland, *Gaveshana*, 3(4): 60.

GHOSH, A.K., M.R. GHOSH & D.N. RAYCHAUDHURI (1972) Studies on the aphids (Homoptera : Aphididae) from Eastern India. XI. Descriptions of hitherto unknown or newly recorded sexual morphs of some species from West Bengal. *Oriental Ins.*, **6**(3) : 333–342.

RAYCHAUDHURI, D.N. & M. CHATTERJEE (1974) A study on the aphids (Homoptera : Aphididae) from Eastern India. XIX. Two species of genus *Eutrichosiphum* including one new from Assam and hitherto unknown alate morphs of *Paratrichosiphum* (*Neoparatrichosiphum*) *raychaudhurii* Ghosh 1969, from Sikkim. *Kontyu*, **42**(2)-122-126.

TAKAHASHI, R. (1965) Some new and little known Aphididae from Japan (Homoptera : Aphididae)-*Insecta matsum.* **28**(1): 19–61.

VERMA, K.D. (1969) A new genus and three new species of aphids from N.W. India (Homoptera: Aphididae). *Bull. Ent.*, **10**(2) : 134–140.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 151 *to* 155

TWO NEW SPECIES OF *TENUIPALPUS* DONNADIEU (TENUIPALPIDAE : ACARINA) AND DISTRIBUTIONAL RECORDS OF OTHER MITES FROM INDIA

G. L. SADANA & S. C. CHHABRA
Department of Zoology, Punjab Agricultural University,
Ludhiana (Punjab), India

(*Received 28 September 1979*)

Two new species of the genus *Tenuipalpus* Donnadieu namely *Tenuipalpus aboharensis* sp. nov. and *T. ludhianaensis* sp. nov. are described and illustrated. Distributional records of *T. mustus* Chaudhri, *T. caudatus* (Duges), *T. dimensus* Chaudhri and *T. punicae* Pritchard and Baker are also given. Of these, the former two are new records from India. A key to the Indian species is also given.

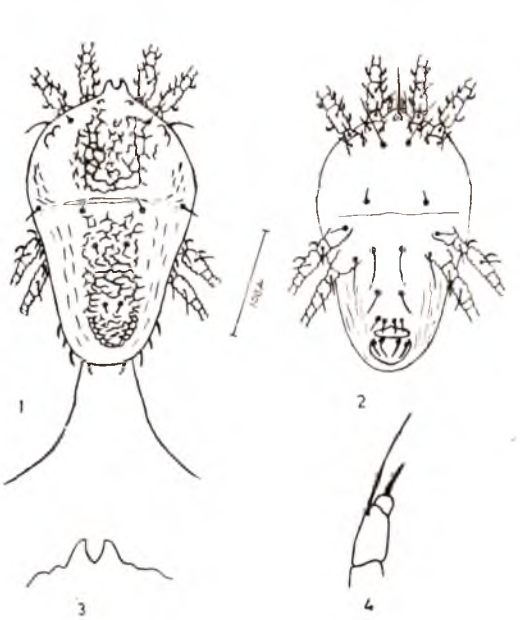
(*Key words:* **new species of *Tenuipalpus*, distribution, mites**)

Tenuipalpus Donnadieu forms the second largest genus of the family Tenuipalpidae and has world wide distribution. Of the one hundred and forty species known from the world, only sixteen species are recorded from India (Menon, Ghai and Katiyar, 1971; Dhooria and Sandhu, 1973; Nagesh Chandra and Channa Basavanna, 1974; Channa Basavanna and Lakkundi, 1976; Maninder and Ghai, 1978). During an extensive survey of northern India, we came across two new species and four known species of genus *Tenuipalpus*. Of the known species, *Tenuipalpus caudatus* (Duges) and *Tenuipalpus mustus* Chaudhri form new record from India. With the addition of these species the total number of the mites of genus *Tenuipalpus* now known from world stands at one hundred and forty two and from India at twenty.

The holotypes and paratypes of the new species and specimens of the other mites are deposited in the acarological collections of the Department of Zoology, Punjab Agricultural University, Ludhiana.

1. **Tenuipalpus aboharensis** sp. nov.
Figs. 1–4

Female : Body 250μ long (without rostrum) and 160 μ wide. Palpus 3 segmented, terminal segment with a sensory rod, 2nd segment with a long and slightly serrate seta. Rostral shield notched medially. Propodosoma with irregular and incomplete reticulations medially, a few complete and incomplete reticulations mediolaterally and thick scattered striations laterally. Propodosomal setae 3 pairs, I and II minute; III slightly lanceolate, 25 μ long. Eyes two pairs, one pair on each side. Humeral setae 1 pair, each 6 μ long. Hysterosoma with irregular and incomplete reticulations but striations anteriolaterally; without anterolateral expansion. Central setae 3 pairs, simple and minute. Lateral setae 6 pairs, I–IV and VI being 5μ, 8μ, 12μ, 12μ, 11μ long, respectively, I simple, others slightly lanceolate, V flagellate, II, III shorter than the distance between II–III and III–IV respectively, IV longer than the distance between IV–V.



Figs. 1—4 : *Tenuipalpus aboharensis* sp. nov. Dorsal view (Legs partially shown); 2-Ventral view (Legs partially shown); 3-Rostral shield; 4-Left palpus.

Venter of gnathosoma without any setae. Ventral propodosomal portion without striations. Medioventral propodosomal setae 1 pair, 52 μ long. Anterior medioventral metapodosomal setae 1 pair, 8μ long. Posterior medioventral metapodosomal setae 1 pair, 37μ long. Ventral setae 1 pair, 15μ long, not crossing the bases of genital setae. Genital setae 2 pairs, 9μ long. Anal setae 2 pairs, outer setae 11μ and inner setae 10μ long. All setae simple.

Ventral and genital plates without striations. Legs 4 pairs, segments wrinkled. Setae on legs I–IV: Coxae 2–2–1–1, trochanters 1–1–2–1, femora 4–4–2–1, genua 2–2–0-0, tibiae 5–5–3–3. Setae on tarsi not clear.

Male : Not known.

Holotype : ♀, encircled on slide No. 51N, ex *Punica granatum*, INDIA: PUNJAB: Abohar, 4. vii. 1978, Coll. S.C. Chhabra.

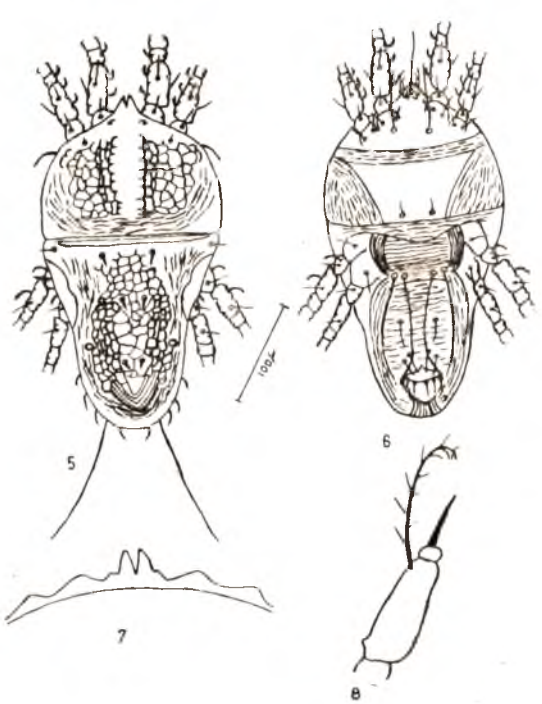
Paratype : 4 ♀ ♀ on the same slide with same collection data.

Remarks : *Tenuipalpus aboharensis* sp. nov. slightly resembles *T. horntinus* Chaudhri but differs from it in the pattern of dorsal reticulations, shape of rostral shield, in having lateral setae IV longer than the distance between IV and V; absence of striations on the genital and anal plates.

2. Tenuipalpus ludhianaensis sp. nov. (Figs. 5—8)

Female : Body 280μ long (without rostrum), and 170μ wide. Palpus 3 segmented, 2nd segment with a pectinate seta and terminal segment with a sensory rod. Rostral shield notched medially. Propodosoma with reticulations mediolaterally, absent in the middle; striations laterally. Propodosomal setae 3 pairs, I and II minute, III 15μ long. Eyes two pairs, one pair on each side. Humeral setae 1 pair, 9μ long. Hysterosoma without anterolateral expansion, with thin and faint reticulations medially but thicker laterally; with a pair of pores; central setae 3 pairs, simple, 8μ, 8μ and 7μ long respectively; lateral setae 6 pairs, I minute, V flagellate, II, III, IV and VI 8μ, 9μ, 9μ and 8μ long, respectively, II smaller than the distance between II and III.

Venter of gnathosoma with a pair of setae. Ventral propodosoma portion with transverse striations in the middle and longitudinal striations near lateral margins. Medioventral propodosomal setae 1 pair, 65μ long. Anterior medioventral metapodosomal setae 1 pair, 14μ long. Posterior medioventral metapodosomal setae 2 pairs, 87μ long and extending beyond the posterior end of the genital plate. Ventral plate and the area anterior to ventral plate with faint and transverse striations. Ventral setae 1 pair, 25μ long. Genital setae 2 pairs, 21μ



Figs. 5—8: *Tenuipalpus ludhianaensis* sp. nov. Dorsal view (Legs partially shown); 6–Ventral view (Legs partially shown); 7–Rostral shield; 8–Left palpus.

long. Anal setae 2 pairs 20μ long. All setae simple.

Legs 4 pairs, segments wrinkled. Setae on legs I–IV: coxae 2-2-1-1, trochanters 1-1-2-1, femora 4-4-2-1, genua 1-1-0-0, tibiae 5-5-3-3. Setae on tarsi not clear.

Male : Not known.

Holotype : ♀, encircled on slide No. 79H, ex *Pyrus communis*, INDIA : PUNJAB : Ludhiana. 10.xi.1978, Coll. Kesar Singh.

Paratype : 4 ♀ ♀ on same slide, 2 ♀ ♀ on slide No. 79J, collection data same as for holotype.

Remarks : *Tenuipalpus ludhianaensis* sp. nov. resembles *T. trisegmentus* Siddiqui and Chaudhri but differs from it in the patterns of propodosomal reticulations; in having six pairs of lateral setae, presence of striations anterior to ventral plate and in the absence of anterolateral expansions of hysterosoma. It also shows resemblance with *T. pruni* Maninder and Ghai but differs in having one seta on trochanter IV and 5 setae each on tibiae I & II instead of having 2 on trochanter IV and 4 each on tibiae I & II as in *T. pruni* Maninder and Ghai.

3. **Tenuipalpus mustus** Chaudhri

Tenuipalpus mustus Chaudhri 1972, *S.U. Res. J.* (*Sci. Ser*). **9**(1): 17–21.

Material examined: ex *Tagetes erecta* and *Xanthium* sp., INDIA : PUNJAB : Habowal 20. vii. 1979, Ludhiana, Coll. Kesar Singh.

This species has been recorded for the first time from India on new host plants.

4. **Tenuipalpus caudatus** (Duges)

Tenuipalpus palmatus Donnadieu 1875, *Annales de la Societe Linnenne de Lyon*, **12:** 111.

Tenuipalpus caudatus (Duges)—by subsequent designation.

Material examined: ex *Acacia arabica*, INDIA : PUNJAB : Bothari (Ludhiana), 11.xii.1973, Coll. Kesar Singh.

This species has been recorded for the first time from India.

5. **Tenuipalpus dimensus** Chaudhri

Tenuipalpus dimensus Chaudhri, 1971, *Pakistan J. Zool.* **3**(2): 205; Collyer, 1973, *N.Z.U.Sci.*, **16:** 922; Chaudhri, Akbar and Rasool, 1974, PL-480 Project on Mites, University of Agriculture, Lyallpur, Pakistan, p. 75; Maninder and Ghai, 1978, *Oriental Ins.* 12(2): 251.

Tenuipalpus ghanii Kazimi, 1972, *Bull. Ent. Res.* 61: 517.

Material Examined: ex *Prunus persica*, 24. vi. 1978, Punjab Agricultural University, INDIA : PUNJAB : Ludhiana, Coll. S.C. Chhabra.

This species is being reported for the first time from the Punjab State. However, it has earlier been reported from Delhi (India).

6. **Tenuipalpus punicae** Pritchard and Baker

Tenuipalpus punicae Pritchard and Baker; 1958, *Univ. California Publ. ent.* 14: 240–242: Dhooria and Sandhu, 1973, *Curr. Sci.*, 41, 179–180.

Material examined: ex *Punica granatum*, INDIA : PUNJAB : Jagraon (Ludhiana); 25.vi.1978, 28.vi.1978 Ferozepur; 2 vii. 1978, Fazilka; 4. vii.1978 Abohar, Coll. S.C. Chhabra.

This species has earlier been reported only from Ludhiana (Punjab) but the authors have recorded it from other four localities of Southern Punjab (India).

KEY TO THE INDIAN SPECIES OF *TENUIPALPUS* DONNADIEU

1. Hysterosoma with four pairs of non-flagellate caudolateral setae 2
—Hysterosoma with three pairs of non-flagellate caudolateral setae 19

2. Hysterosoma differentiated to form an expansion anterior to coxae III..... ..... *T. micheli* Lawrence
—Hysterosoma without such differentiated expansion..... 3

3. Gnathosoma without ventral setae..... 4
—Gnathosoma with a pair of ventral setae..... 6

4. Dorsum with a few thin reticulations..... ..... *T. aboharensis* sp. nov.
—Dorsum with strong reticulations or striations..5

5. Dorsum with strong reticulations..... ..... *T. punciae* Pritchard & Baker
Dorsum with thick striations but middle of propodosoma with thick reticulations..... ..... *T. caudatus* (Duges)

6. Dorsocentral hysterosomal setae one pair.... ..... *T. granati* Sayed
—Dorsocentral hysterosomal setae three pairs.....7

7. Anterior medioventral metapodosomal setae two pairs.....8
—Anterior medioventral metapodosomal setae one pair.....9

8. Setae on femora I–IV: 4–4–2–1..... ..... *T. pernicis* Chaudhri, Akbar & Rasool
—Setae on femora I–IV: 5–5–2–2 .... *T. cissampelosa* Maninder and Ghai

9. Posterior medioventral metapodosomal setae one pair; dorsum with transverse striations.. ..... *T. mustus* Chaudhri
—Posterior medioventral metapodosomal setae two pairs; dorsum with or without polygonal retriculations.....10

10. Dorsum with polygonal reticulations.....11
—Dorsum without polygonal reticulations.....14

11. Second dorsolateral hysterosomal pair reaching upto the base of third dorsolateral pair..... *T. odimensus* Chaudhri
— Second dorsolateral hysterosomal pair not reaching upto the base of third dorsolateral pair.....12

12. Rostral shield reaching upto the anterior end of trochanter I..... *T. pyruseae* .....Maninder and Ghai
— Rostral shield reaching upto the middle of femur I 13

13. Setae on trochanters I–IV: 1–2–1; on tibiae 5–5–3–3..... ..... *T. ludhianaensis* sp. nov.
— Setae on trochanters I–IV: 1–2–2; on tibiae 4–4–3–3..... ..... *T. pruni* Maninder and Ghai

14. Dorsal body setae lanceolate.....15
— Dorsal body setae not lanceolate.....16

15. Dorsum with broad ridges and furrows ..... *T. ixorae* Maninder and Ghai
— Dorsum with simple but prominent linings.... ..... *T. fici* Maninder and Ghai

16. Second palpal segment as long as broad....17
— Second palpal segment considerably longer than broad.....18

17. Rostral shield extending beyond the middle of femur I.....
.....*T. faresianus* Maninder and Ghai
— Rostral shield extending slightly above the anterior end of trochanter I.....
.....*T. acacii* Maninder and Ghai

18. Second palpal segment with false segmentation; propodosoma with semicircular linings in the middle.....
.....*T. indicus* Maninder and Ghai
— Second palpal segment without false segmentation; propodosoma with irregular pattern of transverse and longitudinal reticulations...
.....*T. amygdalusae* Maninder and Ghai

19. One pair of posterior medioventral setae....
.....*T. lalbaghensis* Channa Basavanna and Lakkundi
— Three to four pairs of posterior medioventral setae.....*T. crassus* Andre

Acknowledgements:—The authors are thankful to Dr .S.S. Guraya, Professor & Head, Department of Zoology, Punjab Agricultural University, Ludhiana for laboratory facilities and I.C.A.R. for financing the scheme to carry out the taxonomic work on tetranychoid mites. The help rendered by Meena Gupta, Bimal Kumar and Kesar Singh is gratefully acknowledged.

REFERENCES

CHANNA BASAVANNA, G. P. & N.H. LAKKUNDI (1976) *Tenuipalpus lalbaghensis* (Acarina: Tenuipalpidae), a new species from Southern India. *Indian J. Acar*, **1** (1 &2): 19–22.

CHAUDHRI, W.M. (1971) The genus *Tenuipalpus* in Pakistan.I. Description of five new species (Acarina: Tenuipalpidae). *Pakistan J. Zool.*, **3**(2): 203–212.

CHAUDHRI, W.M. (1972) Description of five new species of *Tenuipalpus* (Acarina : Tenuipalpidae) from Pakistan. *S. U. Res. J. (Sci. Ser.)*, **9**(1): 17–21.

CHAUDHRI, W.M., S. AKBAR & A. RASOOL (1974) *PL*-480 *Project on Mites*. University of Agriculture, Lyallpur, Pakistan. pp. 1–250.

COLLYER, E. (1973) New species of the genus *Tenuipalpus* (Acarina: Tenuipalpidae) from New Zealand, with a key to the world fauna. *N.Z. J. Sci.*, **16** (4): 916–955.

DHOORIA, M.S. & G.S. SANDHU (1973) Occurrence of *Tenuipalpus punicae* Pritchard and Baker (Tenuipalpidae: Acarina) on pomegranate in India. *Curr. Sci.*, **42**(5): 179–180.

DONNADIEU, A.L. (1875) Recherches pour servir a l'pistorie des Tetranyques. *Ann. Soc. Lyon*, **12**: 1–134.

KAZIMI, S.K. (1972) A new species of *Tenuipalpus* (Acarina: Tenuipalpidae) from West Pakistan, with notes on its biology. *Bull. Ent. Res.*, **61**: 517–522.

MANINDER & S. GHAI (1978) Indian species of *Tenuipalpus* (Acarina: Tenuipalpidae). *Oriental Ins.*, **12** (2): 243–258.

MENON, M.G.R., S. GHAI & K.N. KATIYAR (1971) Two new records of false spider mites from India (Acarina: Tenuipalpidae). *Indian J. Ent.*, **33**(4): 469–470.

NAGESH CHANDRA & G.P. CHANNA BASAVANA (1974) Faunistic study of false spider mites (Acarina: Tenuipalpidae) of India. *Internat. Cong. Acarology*, Austria (Abstract).

PRITCHARD, A.E. & E.W. BAKER (1958) The false spider mites (Acarnia: Tenuipalpidae). *Univ. Calif. Publ. Ent.*, **14**(3): 175–274.

Entomon, 1980, *Vol.* 5, *No.* 2, *pp.* 157 *to* 159

BRIEF COMMUNICATION

A NEW GENUS OF ALYSIINI (HYMENOPTERA : BRACONIDAE : ALYSIINAE)

SHAMA BHAT
Department of Zoology, University of Delhi, Delhi 7

(*Received 29 December 1979*)

Descriptions and illustrations of the new Alysiini genus *Eurymeros*, and its type species *Eurymeros tumespiraculum*, sp. nov. from India are given.

(*Key words:* **new genus of Alysiini,** *Eurymeros*)

Eurymeros, Gen. nov.

Body small, shiny and smooth; face, flagellum, legs and ovipositor sheath pubescent.

Head subtransverse, broader than long; face strongly convex, as long as broad, mandible small, thin and tridentate; maxillary palp 5-segmented and labial palp 4-segmented; flagellum 24–28 segmented, basal segments moderately long and distal segments club-shaped, all segments with longitudinal sensillae, first flagellar segment longer than second flagellar segment; ocelli small, interocellar distance less than ocello-ocular distance.

Mesoscutum moderately raised, notauli absent, dimple deep and covers posterior half of mesoscutum; prescutellar depression with one longitudinal carina; scutellum subtriangular, without any spine or carina; mesopleural furrow present; propodeum with a median longitudinal carina bifurcating at basal half, its basolateral areas smooth and apical half reticulated, propodeal spiracle circular and swollen, situated after the middle of propodeum.

Wings about as long as body, stigma distinct and long, r_1 as long as second intercubitus, r_2 longer than first intercubitus, nervulus distad of basal vein, subdiscoideus not interstitial, r_1, arises before the middle of stigma, submediellan cell half of mediella, nervellus distinct and not broken, postnervellus present.

Legs moderately long, hindcoxa longer than fore- and middlecoxae; hindfemur coarsely punctate and pubescent on outer side but smooth and without any pubescence on inner side, hindfemur very wide with 6–7 pairs of ventral teeth.

Abdomen long and narrow, shiny and smooth; first tergite longer than its apical width and without any longitudinal striations; ovipositor sheath as long as hindfemur.

Type-species: *Eurymeros tumespiraculum*, sp. nov.

Eurymeros, gen. nov. keys out in Fischer's (1971) key to the world genera of Alysiini in Group E by having normal wings, discoidal, first and second cubital cells separated, first flagellar segment longer than second flagellar segment, r_2 longer than first intercubitus but it can be separated from all genera of Alysiini by having hindfemur very wide with ventral teeth and the entire abdomen being shiny and smooth.

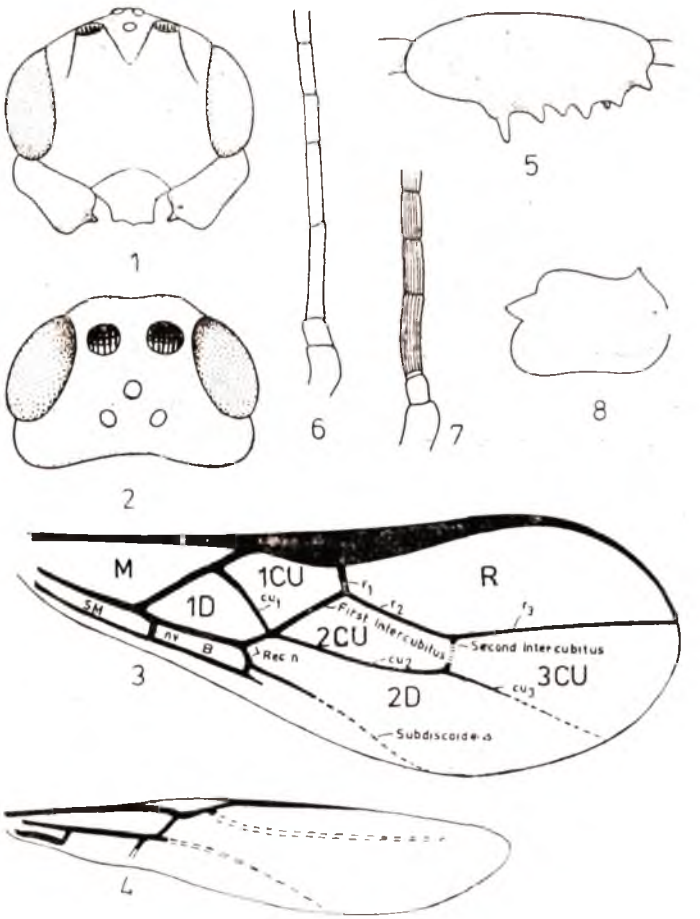
The new genus is close to *Orthostigma* Ratzeburg both having r_2 longer than first intercubitus, subdiscoideus not interstitial and submediellan cell being 0.5 of mediella but the new genus can be separated from *Orthostigma* by the absence of transverse carina on mandible, hindfemur enlarged with ventral teeth, mandibular teeth small and the entire abdomen being smooth.

It also approaches *Aspilota* Foerster in the shape and size of flagellar segments and shape of mandibles but the latter genus can be distinguished by its linear stigma, not separated from metacarp and first tergite longitudinally striated.

The name of the genus is derived from the Greek words, *Eury*—broad and *meros*—femur, referring to its very wide hindfemur.

Eurymeros tumespiraculum sp. nov. (Figs. 1–8)

Male and *female*: Head subtransverse, 1.5 × as broad as long; face convex, very minutely punctate and sparsely pubescent, 1.0 × as long as broad; mandible small, upper and lower teeth blunt and broad and middle tooth slightly protruding and sharply pointed; flagellar segments short with longitudinal sensillae, first flagellar segment 1.5× as long as second flagellar segment; vertex polished; ocelli small, interocellar distance 0.5 × the ocello-ocular distance and 1.4 × the distance between



Figs. 1–3. *Eurymeros tumespiraculum* sp. nov: 1–head (front view); 2–head (dorsal view); 3–forewing; 4–hindwing; 5–hindfemur; 6–antenna; 7–antenna; 8–mandible.

median and lateral ocelli; mesoscutum polished, notauli almost absent, represent at extreme anterior end, dimple distinct and deep; scutellum, meso- and metapleurae smooth; mesopleural furrow short and sculptured, developed at middle of mesopleurum; propodeum with a median longitudinal carina, bifurcating at basal 0.5 of propodeum, areas on basal part smooth and apical half reticulated, propodeal spiracle raised; stigma distinct, 6 × as long as broad, r_1 arises before middle of stigma, r_2 0.5 × as long as r_3, r_3 extending up to wing apex, recurrent vein distad of first intercubitus, 2cu 3.5× as long as broad, nervulus distad of basal vein; hindfemur very wide with 6–7 pairs of ventral teeth; abdomen long, shiny and smooth, first tergite 2× as long as its apical width, a pair of dorsomedian carinaes reaching up to spiracle; ovipositor sheath as long as hindfemur.

Blackish-brown. Mandible, scape, pedicel, fore and middle legs and hind trochanters golden yellow; palpi white; flagellum, mesoscutum and abdomen beyond first tergite brown; wings hyaline, veins and stigma light brown.

Length: ♀, 3.6 mm; forewing 3.3 mm; ovipositor sheath 2.4 mm. ♂, 4 mm; forewing 3.6mm.

Holotype ♀, INDIA : HIMACHAL PRADESH, Ahla, 2286 m, 1.ix. 1971., D. Ram No. JD 120.

Allotype ♀, same locality as holotype, 16. ix. 1971, Girish No. JD 136 (Gupta). Type specimens are deposited in Gupta Collections Department of Zoology, university of Delhi, Delhi-7.

Distribution : India: Himachal Pradesh.

Remarks: The name of the species is derived from the Latin words, *tume* = swollen and *spiraculum* = spiracle, referring to its swollen propodeal spiracle.

Acknowledgements:—The author is indebted to Prof. V.K. GUPTA Department of Zoology, University of Delhi for his collections and valuable suggestions. This research was carried out during my tenure as a Pool officer of the Council of Scientific and Industrial Research in the Department of Zoology, University of Delhi. I am also grateful to the Head of the Zoology Department, University of Delhi for laboratory facilities.

REFERENCE

FISCHER, M. (1971) Untersuchungen uber die europaischen Alysiini mit besonderer Berucksichtigung der fauna Niederosterreichs (Hymenoptera: Braconidae). *Polskie Pismo ent.*, **41:** 19–160.

INFORMATION TO CONTRIBUTORS

General: ENTOMON will accept original articles arising from studies on insects and other land arthropods. However, papers purely of morphological, histological or anatomical nature based on light microscopy will not be considered. Material submitted for publication in the journal should not have been published or submitted for publication elsewhere. Copyright of the articles published in *Entomon* will remain exclusively with the AAE. Manuscripts in duplicate, including figures, must be sent by Registered Mail to the *Managing Editor, ENTOMON, Department of Zoology, University of Kerala, Kariavattom, Trivandrum, India 695581.*

Articles should be in English only and may be either *Brief Communications* not exceeding two printed pages, or *Papers* normally not exceeding ten printed pages. Reports not exceeding a column will also be accepted for publication. The authors should consult a recent issue of the journal and follow the style closely.

Text : Papers may, as far as possible, be organised as under: Abstract, Introduction, Material and Methods, Results, Discussion, Acknowledgements, References, Legend, Table, and Foot-notes. All pages should be numbered serially. Brief Communications need not have the above format.

Articles should be neatly type written double spaced, including References, Legend, Tables etc., on one side only of good quality bond paper, leaving sufficient margin.

Foot notes should be avoided as far as possible. When included they should be given on a separate sheet. In the text, reference to foot notes should be indicated by superscript numerals.

Tables should be numbered in Arabic numerals, and should be given on sheets separate from the text. The approximate position of tables in the text should be indicated in the left margin and cirled.

Illustrations should accompany the script separately. The short title of the article and figure number should be indicated on the reverse side of the illustrations. Legend should be typed on sheets separate from the text. Line drawings and photographs should be consecutively numbered together in Arabic numerals without distinction between drawings and photographs. Photographs should be organised and mounted in the form of plates. The approximate position of the illustrations in the text should be indicated in the left margin and circled. Blocks up to an equivalent of one full page size are allowed free of cost. However additional blocks will be fully charged for. Authors are advised to carefully plan their illustration so as to occupy minimum space and permit sufficient reduction. This is in the interest of the authors as well as the journal.

Use only **metric units** as far as possible. Abbreviations of units should not be followed by full stop unless to avoid confusion.

References should be cited in the text by name(s) of author(s) and year of publication as: NAYAR (1958), or (NAYAR, 1958), NAYAR *et al.* (1970) etc. Abbreviate titles of periodicals according to *World List of Scientific Periodicals*, 4th ed., Butterworth, London (1963). The following style should be used for listing references:

Articles in journals: NAYAR, K. K. (1958) Studies on the neurosecretory system of *Iphita*. V. Endocrine basis of oviposition in female. *Proc. Indian Acad. Sci.*, **47B**: 233–251.

NAYAR, K. K., M. BALLS & E. ARTHUR (1970) Transmission of amphibian lymphosarcoma to and through insects. *Oncology*, **24**: 370–377

Books: NAYAR, K.K. (1973) *Elements in Insect Endocrinology*. Prentice Hall, India, 56pp. *Chapter in a book compiled and edited*: GILBERT, L. I. & D. S. KING (1973) Physiology of growth and development: Endocrine aspects, 249–370. *in: The Physiology of Insecta*, Vol. **1**, 2nd ed. (ed. ROCKSTEIN, M.), Academic Press, New York & London.

Reprints: No gratis reprints will be supplied. The number of reprints required should be specified as soon as the paper is accepted for publication in the journal. Table showing the cost of reprints will be supplied to authors when acceptance of the paper is communicated.

Editors reserve the right to revise the wording of manuscripts accepted for publication. The authors are solely responsible for the views expressed in their articles.

Reg. No. R. N. 29386/76

ENTOMON is covered in the following abstracting / indexing journals : *Chemical Abstracts* (Chemical Abstracts Service, The Ohio State University, Columbus, Ohio 43210, U. S. A.), *Review of Applied Entomology* (Commonwealth Institute of Entomology, 56 Queen's Gate, London SW7 5JR, England), *Current Contents / Agriculture, Biology & Environmental Sciences* (Institute of Scientific Information, 3501 Market Street, Philadelphia, Pa. 19104, U. S. A.), *Biological Abstracts* (Biosciences Information Service, 2100 Arch Street, Philadelphia, Pa. 19103, U. S. A.), *Entomology Abstracts* and other relevant *Abstracts* (Information Retrieval Limited, 1 Falconberg Court, London WIV 5FG, England), *Referativnyi Zhurnal* (The Institute of Scientific Information, Academy of Science of the U.S.S.R., Baltijskaya ul., 14, Moscow A – 219, U. S. S. R).

Printed by V. K. K. Prabhu at St. Joseph's Press,
Trivandrum for the Association for Advancement of Entomology.